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Archives of Neurology and Psychiatry

VOLUME 16 NOVEMBER, 1926 NUMBER 5

NEUROLOGY AND EDUCATION *

FREDERICK TILNEY, M.D.
NEW YORK

We are gradually beginning to conceive of neurology in its wider applications. It now appears to be something of greater dynamic power than that needed for the care of those who fall victims to disease. Its original defensive attitudes in this respect, even its more modern activities in prevention, must ultimately be supplemented by progressive efforts which have as their goal the extension of human happiness through the development of intelligence.

Neurology is the study of all phases of that dominating system of the body which controls the entire process of behavioral adjustment and human evolution; that system which has carried man forward from one stage of his progress to the next, which has made him what he is, which holds out to him his only chance of improvement.

It is to one of the most important relations in this broader conception of the neurologic field that I would call your attention. This seems to be a subject worthy of your thoughtful consideration, for you—above all others—by reason of training and understanding, are most capable of furthering the cause in behalf of which I speak, namely, neurology in its relation to education.

Many present difficulties, many past catastrophes in civilization, may be attributed to fundamental deficiencies in educational development. This point of view estimates education in its broad sense, as a process depending on the actual training of the brain. This training may make much or little, good or bad, proper or improper use of the brain's capacities.

The briefest survey of the past, not alone of history but also of the vastly longer period of prehistory, reveals a remarkable sequence of events. In certain instances the training of the brain power produced what we call civilization, or some stage of cultural advance. Yet, with singular persistence, this brain endowment has been insufficient to maintain what it has created. It has rather consistently tended to destroy the many successive phases of civilization.

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* Presidential address delivered at the Fifty-Second Annual Meeting of the American Neurological Association, Atlantic City, N. J., June 1, 1926.

According to the generally accepted view of modern scientific opinion, the cradling place of mankind was somewhere near the center of the Asiatic continent. Numerous migratory waves have gone forth from this generative region in all directions. The northerly path took the Eskimo to his Arctic isolation. The trail of the south and southeast conveyed the Negroid and Mongol races into the tropics. It led them, like the Eskimo, in that developmental retardation characteristic of the earlier stages of human differentiation. The easterly trail conducted the American Indian to his famous hunting grounds, but left him able to advance but a short distance through stages of paleolithic culture.

All these migratory routes were the paths of inhibition. They yielded little of the promise held in the potential development of the human brain.

The westward trail, leading toward Europe and the Mediterranean basin, alone was the path of progress.

More than 100,000 years ago primitive man began to work out his destiny and pass through successive cultural phases in western Europe. Early Chellean culture gave the first decisive signs of his progress. He advanced to the Acheulian period, reached his climax and began to decline in the Mousterian. Like his predecessors, Neanderthal man finally succumbed and gave place to the great Cro-Magnon race. These newcomers saw the beginning of their ascendancy in the Aurignacian period when they introduced the arts of engraving and sculpture. They reached the zenith of their supremacy in the Solutrian era. But their flourishing activities then began to wane. Through the Magdelenian era all of their artistic brilliancy sank toward the horizon of its disappearance. At length in the Azilian period, the last survivors of the greatest race in the Old Stone Age, senescent in their industries, decadent in their art, saw the setting of the Cro-Magnon sun and the passing of their kind into the darkness.

So it has been with every wave of migration which followed the western path from Asia toward or into Europe. Whatever glories might have come of following this route were temporary at best. Man moved along its course in an unfailing cycle which had a metrical rhythm almost as exact and quite as foreboding as the chorus in an ancient Greek tragedy. There was that phase which announced his arrival or awakening, that rise which gave the full measure of his worth, that slow but sure decline, that invariable destruction which overtook him.

The persistent procession of these phases seemed to exert a baneful influence on all of his efforts toward progress, whether the part he played was that of Heidelberg or Piltdown man, Neanderthal or Cro-Magnon, Egyptian or Babylonian, Greek or Roman.

Neither medieval nor modern history has produced a more reassuring record. One characteristic in this cycle stands out preeminently. It is

the inability to maintain that which has been produced at the expense of such great labor.

Perhaps in these human reactions there is a basic similarity to the behavior of the great anthropoids. The likeness may furnish a key to the explanation.

Professor Köhler has recently given us the benefit of his psychologic studies. He shows that the more advanced simians are capable of certain constructive achievements. These animals are able to build and in their building show a measurable degree of cooperation. To obtain food suspended above their heads and out of reach, they work together. They pile one box on another to construct a tower-like edifice by means of which to reach the object of their desire. Always, however, at about the time when the tower is completed, some unruly member of the group more or less maliciously topples over the whole structure. This destroys the product of much toilsome enterprise and precipitates a Babel-like conflict among the simian architects.

The conclusion is obvious. By training, these anthropoid brains were sufficiently conditioned for purposive building, but not enough to avoid ruthless breaking.

Here, no doubt, in its simplest terms, is the prototype of that ancient cycle in man's effort toward civilization. One of the most distinguished authorities of our day, Prof. Henry Fairfield Osborn, has made the statement that mankind, in his uncivilized state, is subject to the same orderly laws as those which prevail throughout the animal kingdom. But the introduction of civilization interferes with the natural regulation of things, and man himself appears to be upsetting the order of human progress.

The recent sanguinary events of modern times, with their immediate atrocities and many disastrous consequences, create no strong feeling of security in the present status of the race. There are doubtless good reasons for the many failures in man's upward striving to become civilized. There must also be reasons why human understanding has been inadequate to combat the disintegrating forces which pursue its best efforts. Is it not fair to presume that the most potent factor in this deficiency is the imperfect development of the human brain?

Not long since, the noted British anthropologist, Sir Arthur Keith, declared that man had not utilized more than one half of his actual brain power. This estimation appears almost too generous. It seems more likely that scarcely more than one fifth of the brain power has been developed.

The exact fraction is immaterial. The fact may be demonstrated that we cultivate at best only a portion of our brains.

A cross section of any large community would suffice to show that the average mental capacity of all individuals, thus estimated, does not

represent anything like the possible developmental power of the human brain. This test, applied more generally to a nation or to a race, compels a similar conclusion. The comparison of the brain power of living and primitive races with individuals of these same races under the influences of civilization, indicates the different possibilities in brain development.

The truth of the dictum that only a fraction of the human brain has been employed for the ultimate purposes of man becomes still more clear in considering individual development. All members of the human family today are predominantly either right-handed or left-handed. Clinicopathologic researches have shown that speech centers develop in the left hemisphere of right-handed people, and vice versa for left-handed people. Thus, by education and training, one hemisphere of the brain is more developed than the other.

A recent article on aphasia by one of our British members, Kinnier Wilson, in his usual inimitable style, urges ambidexterity to educate both sides of the brain equally. Obviously, then, such training as makes for right-handedness leaves one half of the brain far less available than the other.

In certain departments of brain activity there are examples in which a special sense, by persistent training, develops much beyond the attainments of the average person. This is evident in the auditory acquisitions of the musician, in the kinesthetic and motor achievements of the instrumentalist, in the visual specialization of the artist. To some extent it is true of the sense of taste and smell. This is exemplified by experts who employ these specialized receptors in tasting foodstuffs or certain beverages. All these specializations show the possible range of brain development. They represent differentiations of local areas of the cerebrum.

Even more illuminating are the cases of deaf mutes also blind. They have but a single sense to educate and depend on. This is the sense of touch, for the most part confined to the hands and fingers. A notable instance of this kind in our day is that of a young woman, who, thus handicapped, has so developed her efficiency through the unaided sense of touch, that she has made an adjustment to life at least as satisfactory as the average normal adult. If she has been able to educate this single sense to such a high degree of efficiency, it is evident that the possibility of such development must be in every human brain.

From our present knowledge it is fair to assume that each one of the several senses is capable of similar expansion. Vision, hearing, touch, smell and taste, all expanded proportionately and contributing their quota to the broadening of human experience, understanding and judgment, could not fail to make a greater success of life. One of our great problems is to learn how this further expansion may be brought about.

Instances might be multiplied showing that the human brain falls short of producing its full power. These deficiencies may not be attributed to defects in cerebral structure. They are due rather to the inadequacy of the means employed to bring out the best the brain has to give. All such agencies as contribute to this development may be regarded as education, and hence the failure—whatever it is—must be laid at this door.

The brain is fundamentally an organ to adapt the animal to a biologic environment. Human evolution has greatly increased the complexity of this environment until it has become preeminently sociologic. In its present form it is largely man-made.

If we endeavor to visualize the broad scheme of existence, we see at once that the adaptation of the organism to its surroundings requires a special mechanism. This is now known to be a structural combination in the nervous system which permits given causes to produce definite effects. The product of this mechanism's activity is the conditioned reflex. The sum total of all such reflexes expresses itself in the animal's behavior.

The conditioning of this reflex mechanism is, in essence, the biologic basis of all education. A simple environment requires simple conditioning to produce adequate adaptation. A complex environment demands complex education.

The conditioning itself may be natural or artificial. For example, the conditioned salivary reflex in dogs on the sight of meat represents the response to a natural condition. The conditioned salivary reflex in dogs on the substitution of a blue light or the sound of a bell for the meat is response to an artificial condition.

In uncivilized man, as in the rest of the animal kingdom, the conditions are natural. In civilization the conditions become progressively more artificial. The responsibilities of education thus become greatly increased. Training may be directed by intelligent conditioning for proper adaptation. It may build up a system of artificialities based on delusional substitutes.

Numerous excellent examples of this sort of conditioning may be found in the histories of many nations. They show how peoples have been educated to believe in their own national supremacy and activated thereby to the aggressions of conquest.

The disastrous results of such faulty education seem capable of carrying their warning message but a short way and for a short time. The lesson has been written over and over again in dismal failures. It has not yet found an abiding place in human understanding.

Utilized as it has been, the human brain would appear to be almost as much a liability as it is an asset. Two causes seem to underlie this

liability. First, we have not employed all of our brain capital. Second, we have failed to make the best use of what we have employed.

Are we bound to these delinquencies in perpetuity? Probably not. There is reason to believe that our stage of civilization offers a more advantageous point of departure toward real progress than any previous stage. A totally new and potent factor has begun to exert its influence on us.

After more than fifty years of resistance and objection, the truth of the evolutionary theory is being more generally recognized by thinking men and women. The realization that such a process has been at work throughout nature awakens new interest in the possible further progress of mankind. It becomes more clear that the chances of such progress depend largely on determined, intelligent human effort.

Many people still hesitate to accept this evolutionary view as it seems to imply the descent of man from apes. Yet there is not a scintilla of evidence to prove that man descended from any of the apes, big or little, living or fossil.

These animals belong to families entirely distinct and widely separated from the human family. They have become most effectually arborealized, have gone well up into the trees where doubtless they will remain, quite as indifferent to the origin of man as they are innocent of participation in it.

To consider the human race of simian derivation is a trifling, inconsequential, incomplete and belittling view of evolution. It misses the point altogether. Why should we single out the apes as our ancestors? Why not better trace back the line of descent, step by step, through the common mammalian stock to the earliest paleozoic progenitors of our kind?

The appreciation of this long ancestral lineage through its many geologic phases gives the proper value to the evolutionary process. Perceived in this way, it is possible to sense the full force of that biologic momentum which has carried the great vertebrate phylum upward and onward through the ages and may still carry us forward.

This is a conception which makes urgent appeal for thoughtful consideration regarding further possible readjustments of human behavior. It is a view of life which requires for its acceptance real powers of vision combined with an open attitude of mind. For now, as in the past, intolerance may resist as rude intrusion any trespass on its ancient and venerated delusions. Prejudice may reject as worthless what it has not itself conceived as true. Conservatism may urge a wary hesitation in accepting broad conclusions of any kind.

But the facts are open and clear to all who can and will see. They show a long, slow but progressive development of the vertebrate brain

which reaches its evolutionary acme in man. They imply a possibility of more progress along the lines of greater brain development and still better adjustments to life.

If the recognition of these facts brings with it a new inspiration, it also imposes a new and weighty responsibility. It calls for a decisive change in our almost casual attitude toward the chief organ of the nervous system. The brain has been sufficiently identified with processes of disease and disintegration. It now must be realized as the only instrument for further success and progress.

It is easy to discern that education at present is too narrowly conceived. It is limited to certain scholastic and academic periods of life, restricted to certain circumscribed courses of what we choose to call culture. In its present administration it is much more intent on ornamenting the personality rather than developing its full usefulness. It fails to provide a sustained, coordinated, well rounded discipline, to develop the physical, spiritual, social and economic life of the individual.

These matters have not yet become objects of first importance in the organization of our schools and universities. It is true that some efforts have been made along these lines in isolated institutions. As beginnings, these are hopeful signs. They deserve enthusiastic support. But their aspirations and principles should have a nation-wide circulation.

Particularly significant in this regard is the promising endeavor on which Vassar College has embarked. In its new department of euthenics it purposes to cultivate the science of right living. Its specific intention is the development of the learned profession of motherhood. Although devoted to this oldest, most fundamental concern of the race, it brings, through scientific understanding, a powerful force to the betterment of social organization. In substance it is the science of humanity applied to the rearing of children, to the proper development of the home, to the intelligent improvement of the community. It inculcates the meaning of those essential responsibilities inherent in duty to the human family.

Such learning should not be limited to women who happen to be graduates of colleges. It is the education which should be the common possession of all women. Many believe that understanding of this kind comes by intuition as a birthright. So, no doubt, it does. But special training of it can scarcely fail to enhance its usefulness. Equipped in this respect the mother will be better able to prepare the way, in preschool childhood, for the school life. She understands what further is necessary in the education of her children when the school period is begun. She is in no quandary as to the objects of education. Her alert interest, her watchful sympathies, her intelligent activity, are all enlisted in favor of that process which takes over the personality in those

impressionable years when character is in the making, when the embryonic elements of good citizenship are ready for the full imprint of American ideals.

Such mothers will know what sort of teachers to demand for the instruction of their children. Their supervision from the earliest periods of character building will exert still greater influence in molding the citizenship of the nation.

Alfred Russell Wallace, who shares with Darwin the distinction of revealing the law of natural selection, prophesied the effects of this far-reaching influence. He emphatically stated that the only possible regeneration of the entire human race could and would be accomplished by the efforts of women.

Much of the criticism of preliminary education is probably well founded. This applies to the preschool period as well as to the primary grades. It is only fair to say in extenuating these primary defects that much must be laid to overcrowding in most schools. This cramps the efforts of the teachers as it limits the opportunities of the pupils. Such faults are in no wise chargeable to the schools. They come directly home to those who provide the opportunities for education.

In the case of our own political organization, the finger of reproach may not be pointed to our officials or to our legislators. It is directed at us as a people because we give too little thought and support to the developmental agencies on which national happiness depends.

A large percentage of life's failures, its maladjustments and disasters have their roots in the earliest preliminary education. Their depressing effects spread out from the family into the community at large. Although we recognize the truth of these facts, we are casual in our endeavors to remedy them. We do not give education the extensive and earnest consideration which the subject deserves. We are content to delegate these matters to the select few who choose to consider themselves educators. By this delegation we believe that we have discharged our duty.

The subject is one which demands and must ultimately receive the fullest consideration of all intelligent citizens. The older method of shifting the responsibility is as dangerous as it is archaic. In this regard we can no longer follow the custom of our ancestors, do as they did, think as they thought. This undoubtedly is the easiest way. It entails no real labor or thought on our part. It produces results which will be as they have been in the past. We will continue to struggle, to fluctuate between the recurrent blood-lettings of war and the dissatisfactions of peace—in a word, be about the same old human race which started out ages ago in search of better things.

If we are generally satisfied with this sort of life, there is nothing simpler than to go on along the way we are now pursuing. If, by

chance, we believe there is anything more satisfactory ahead as a future, we may well begin to think of it now. We may even so particularize this thought as to make it eventually governmental. We may urge that a few less billions be spent on war and the preparations for war in order that a few more millions may be spent on education. We may evince a strong desire for more scholarships and fewer battleships. We may even venture to ask effectual representation of this most important aspect in our life—namely, education—in the government.

This vital interest of our existence as a nation is worthy of aid from every agency which may be mustered to its better organization, its more practical effectiveness. It particularly needs the beneficent influences of federal participation on a far more extensive scale than at present. The latent powers of the Federal Bureau of Education might well be developed:

1. To integrate the scattered forces of educational interests.
2. To cultivate and support investigation in the complex problems of education.
3. To survey the field as a whole throughout the country.
4. To indicate where and in what particulars educational endeavors are below standard.
5. To act in an advisory capacity when expert advice may be most effectually turned to the best advantage and happiness of the people.

This is not in any sense a plea for reform. It calls for no radical or new departure. It is an urgent appeal for more thought, more earnest consideration by all who cherish the ideals originally embodied in the American conception of the government. Put forth a hundred and fifty years ago by the inspired patriots who founded our republic, this potent factor has reached every quarter of the globe. Its effects were visible in the reconstruction of French institutions. It encouraged the aspirations of South America and won independence for republics stretching from the Rio Grande to the Straits of Magellan. It played its part in the gradual liberalizing of British institutions. It showed the way for the great federated republics of the Dominion of Canada, the Australian Commonwealth and the Union of South Africa. It has reshaped the political attitude of the entire civilized world. In 1776 not one republic of importance existed except in Switzerland. Government was represented by a series of monarchies. Monarchy today, to all intents and purposes, has disappeared from the earth. Where it still exists it has become or is fast becoming hereditary presidency. In the words of a noted British publicist, the Declaration of Independence was the birth not of one nation, but of many nations.

This great influence should not fail in its further mission of extending human happiness. It may not be perpetuated by recourse to enleagued force. It can be advanced but little by further limitations

of armaments. It will not prosper in an atmosphere of moral tinkering by means of prohibitory or compulsive measures. The only sure avenue open for its actual progress is through an orderly process of better education.

This is the keynote in the national aspirations of the first and greatest American, which he reiterated again and again. In one of his early messages to Congress, Washington said: "Nor am I less persuaded that you will agree with me in the opinion that there is nothing which can better deserve our patronage than the promotion of science and literature. Knowledge is in every country the surest basis of happiness."

Again in his farewell address he uttered the same thought advocating the primary importance of institutions for the general diffusion of knowledge. "In proportion as the structure of a government gives heed to public opinion, it is essential that public opinion should be enlightened."

He strongly urged the establishment in the United States of a central university for the training of youth, and in his will made a bequest to the national government on condition that it cooperate in carrying out his wish for a national university.

From first to last, the importance of education to the prosperity and happiness of the nation has been fully appreciated by our foremost thinkers. It is fitting that these inspiring words of Washington should recently have been recalled from the past by our present great Chief Executive. What is in President Coolidge's mind with reference to education must be clear from the emphasis which he laid on these wise admonitions made a century and a half ago.

We are fortunate that the trust in and enthusiasm for education still dominates our leaders. The spirit, the faith, the vision of Washington are forcibly expressed by our President.

"The country," he says, "has prospered. Our government is secure. But that prosperity and that security flow from the school and the church."

There is no lack of leadership in this direction, no dearth of hearty sympathy and full understanding in the head of our nation. The deficiency is with ourselves.

Here and there sporadic efforts show laudable aspirations in the right direction. But the subject requires national coordination and the widespread cooperation of those who can still think of larger communal interests beyond their own immediate needs.

If not in our day, surely some generation will see the light and begin to take up this problem in all seriousness. We, who are not unmindful of its pressing urgency, might well enough be the first to undertake it. It is possible for us at least to set in motion the careful deliberation which in time will carry the matter to beneficial conclusions.

One of the chief defects in the scientific pursuits of the present day is the lack of continuity from generation to generation. New phases in every field of knowledge are sure to develop. These must be valued at their true worth and adapted to the basic doctrines already brought to light by previous thought. The science of education, especially, falls into this class. Old, tried and established principles should not be lightly relinquished.

It cannot be expected that so great a problem as this one may be solved within the lifetime of any person. But the combination of courageous, farsighted, level headed, intelligent men and women, each in their own day advancing to their duties and opportunities, would determine a higher degree of education than anything which has previously existed. The unhappiness and distresses directly attributable to ignorance and to faulty education would be immeasurably diminished.

A better understanding of the biologic laws governing life would eliminate many of our present physical and psychologic maladjustments. Malice, envy, uncharitableness, class jealousy, race prejudices, international enmities are the direct products of improper training.

A recent writer on education claims that most of the cruelty and pain which we have endured are due to the fact that we are lazy, cowardly, hard hearted and stupid. It is imperfect education which has inculcated these bad qualities, and good education which is the key to the only new world left to be discovered. If we are intent on such a discovery, we must be diligent, courageous, tolerant and wise, supported at all times by an unwavering faith in the worthiness of our objective.

In these remarks I have endeavored to show that we have not yet made as much as we might make of our brain power. The means for further development is in our own hands if we choose to use it. Many, if not all, of our present problems may best be solved in this way. The process of this development depends on better conditioning of the brain, on greatly improved educational methods and more adequate education. As the master organ of the nervous system is the basis of all further progress, we as neurologists should be the first to see the opportunity, to accept the responsibility and to lead the way.

NEUROLOGY AND ELEMENTARY EDUCATION*

CHARLES K. MILLS, M.D., LL.D., PHILADELPHIA

Dr. Tilney has made an excellent choice of a subject for the annual presidential address. Education should make a strong appeal to the members of the American Neurological Association which has for one of its chief concerns the discussion of the potentialties and activities of that great organ of intelligence, the human brain. Education is the keynote of all lasting progress, and the brain is the organ through which such progress is made. The evolution of the brain becomes a supreme object of interest to the educator, whose duty it is to

* Remarks in the discussion of Dr. Tilney's presidential address.

guide the child and youth. Dr. Tilney has aptly pointed out the manner in which the brain develops as education advances.

Let me at once give my adherence to the recommendation for the establishment of a federal department or ministry of education, having at its head one of the President's cabinet officers. The cause of education should not be represented simply by a bureau of some other department, like that of the Interior, Commerce or Agriculture. A Department of Education should stand on its own feet and direct its own activities. Its great purpose should be the coordination throughout the country of the resources and methods of education. It need not interfere with the rights of the states as some have suggested; nor need it interfere with religious schools, Catholic or Protestant, or with private schools, preparatory or collegiate. It should aim, however, to make the public schools so valuable that the citizens of all religions and races should prefer the schools supported by public taxation to all others.

The rôle of the neurologist in education cannot be overestimated. In the department of research which has been created in some cities in connection with the public schools, investigations should be directed largely to the brain. The health of school children has in recent years received more and more attention from the states and muncipalities. Inspectors have been appointed by departments of welfare and health for school districts and in some instances for schools. The heart, the lungs, the digestive and other organs, the eyes, ears, teeth and throat are duly examined and reported on, to both teachers and parents. Attention is largely accorded to the shortcomings due to deprivation, like bad vision, but the nervous system has not received its due proportion of attention, although some work in this direction has been accomplished and more has been promised. The health of the brain of the child in the last analysis is the most important factor to his success.

The neurologist can determine best the influence of heredity on the education of the child. In recent years discussion has been active and sometimes acrimonious about the comparative influence played by environment and heredity. It has been asserted that no matter what the heredity, the early environment of the child will largely determine his success in education and later in practical life. This is not altogether true. The influence of heredity has been working for generations in the forebears of the pupil or student. This influence cannot always be sought for in the immediate or recent lineal ancestry. A child may recall physically and mentally an aunt or an uncle more than his parents, or a grandaunt or a granduncle more than his grandparents. The explanation of this is that the influence of some strain which is present in the remote ancestry of both the lineal and collateral stock is exhibiting itself.

For economic reasons education must be largely standardized. The state cannot afford to provide a tutor for every child, and if it could do this it would not be altogether desirable. The coming together of children provides the stimulation of competition and the pleasures of social intercourse. Undoubtedly, however, too many pupils are often assigned to one teacher, and the teachers are as a rule paid too little for the arduous work that is demanded of them.

Most children can live up rather well to a general standard of instruction, but for some this is absolutely impossible, hence comes the necessity of selection, which is especially to be applied in the interest of those who are found lacking. In some instances only a trained neurologist is capable of performing this task of selection. He also, more than any one else, should be able to suggest what is best to do for the individual selected as wanting in mental capacity because of some brain aberration or deficiency.

I use the term selection advisedly. In the elementary grades, work should be compulsory. Children are not able to elect for themselves what is best for them to do. Election by pupils or students should not come into play before the senior year of the high school, and then it should be used conservatively.

Besides the two classes of pupils — those of average capability and the defectives of different types — a group of particularly bright and capable pupils is sometimes found. These pupils have unusual powers of mental digestion and assimilation. When possible they should be separated from both those of the average capability and those who are deficient and defective. The work of such pupils may sometimes be arranged so that they can skip grades between the sixth and eighth. It may be unjust to hold them back.

I am not speaking here of those rare cases of precocity in learning that are occasionally encountered, not of the Popes who lisp in numbers nor the Mozarts who compose great symphonies at eleven. Such geniuses will take care of themselves or will be cared for by their admiring elders.

As I have cited elsewhere in an article on educational deficiencies, a distinguished university professor expressed the opinion that "75 per cent of the graduates of our American universities are unable to speak and write the English language correctly." As I believe that the cause of this sad condition goes back to elementary education, it may not be out of place to say a few words about the mental powers and the conditions of the brain at birth, and also at different stages during the first decade of life. I might also consider the best methods of training which should be adopted in accordance with the gradual development of the brain.

The normal child is born through inheritance with the power almost ready to become evident of handling, seeing and hearing. He grasps and studies with his hands differences in size, shape and texture. He soon learns to recognize the persons and large objects which come within his visual range. The voice of the mother and the nurse and the songs of the birds in the cage or in the tree arrest his attention and awaken in him pleasurable emotions. He is endowed at birth or soon after with brain centers and tracts which soon enable him to equip himself with these elementary powers or adaptations. He learns by observation and habit to stand and walk. The earliest method of education should be used to extend and improve these early powers, which means, of course, to develop the brain.

The kindergarten system, therefore, naturally should come into use at a very early period. Children differ a little as to the age when the kindergarten methods become applicable, but it might be stated in general terms to be between the ages of 4 and 6. The parts concerned with the pioneer method of handling, touching and seeing are brought out by kindergarten methods, the brain itself developing step by step with hearing, smelling and the other senses.

The child receives a certain equipment in language during its early period, largely by imitation and repetition. The use of language now becomes the keynote of further development. The brain through heredity has potential centers, areas and tracts concerned with language, both spoken and written. The next step is to develop these brain regions. The skilful and orderly manner in which the first studies in speech are carried out will do much to determine the future education of the child.

Great attention should be paid, in laying out the course of instruction in the lowest grades of elementary school, to what the normal brain of a child of 6 or 7 years is capable of receiving and using. Teachers would be vastly

better equipped for their work in the early grades of instruction if they had a knowledge of the anatomy and physiology of the brain at different periods in its development. In the schools devoted to problems of education, this anatomic and physiologic instruction should hold first place.

Elementary education, even in the lowest school grades, is made most effectual by real habits of mental work which should be gradually increased. One of the present tendencies, not altogether good, is that of introducing too much play into the school. The education of children should be made agreeable, as far as it is possible, without destroying its meaning. Just as a muscle develops in size and contour the more it is worked and the more it is subjected to a variety of work, so the brain develops in size and shape through work. Convolutions and areas develop and take the place of and change the form of fissures in obedience to functional activity.

To one of our own members, Dr. Samuel T. Orton, we owe a valuable contribution to our knowledge of one form of language defect observed in the elementary grades of our schools. The article by Dr. Orton[1] dealt with word-blindness in school children. He believes that the designation "word-blindness" is not strictly applicable to the cases under consideration and therefore suggests the term "strephosymbolia." The prefix "strepho" has been chosen to indicate the tendency in these cases to reversals and the turning about of the letters, words and phrases.

Strange to say, some bad writing and spelling seem to be due to the tendency of pupils to return to ancestral traits and antique forms. This point is emphasized by Dr. Orton, who cites from Professor Ullman and other archeologists the fact that examinations of ancient inscriptions show that these were written either from left to right or from right to left or that the writing might proceed first in one direction and then in another, as oxen plow successive furrows. Orton showed that many of such language deficiencies could be improved or cured by methods of careful and persistent training.

A remarkable case has come under my observation, which shows how other qualities of the mind are sometimes largely dissociated from those particularly concerned with speech or language. A young girl of good physical development and intelligence has never been able to acquire the ordinary use of language by sight. She can walk, run, ride, dance and obtain information through her hearing and other senses except vision, with unusual facility. Her progress in reading and writing has been so retarded as to be almost nil, yet by the use of her ears and general powers of observation she is able apparently to keep pace with other children. She shows a remarkable shrewdness in getting around her deficiency. At a moving picture exhibition, for instance, she will comprehend with readiness the story as it is portrayed, but can scarcely read a word on the screen which explains the different stages of the story.

In concluding these remarks, let me direct attention to a few points in elementary education which are of a special interest to both the neurologist and the educator.

It has sometimes seemed to me that it might be desirable to resort to the teaching of a fundamental language like Latin, as it is done to some extent in England, in the early grades of elementary education, but as this cannot well be done with out present American tendencies, the teaching of etymology should be diligently pursued in the early training of children. Such instruction should be carefully graduated as years are added. The acquisition of the

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1. Orton, S. T.: Word-Blindness in School Children, Arch. Neurol. & Psychiat. **14**:581 (Nov.) 1925.

meaning and derivation of words should go hand in hand with the developing of the brain. Large cerebral areas and tracts concerned with the mechanism of speech are present in the brain, especially in the left hemisphere, and teachers should be carefully trained in the neurologic facts and principles which apply to this branch of education. Schools and departments of pedagogy have courses on this subject, but these are too largely concerned with studies in psychology rather than with organic neurology which should form the basis of such studies. The all important thing is to teach the neuro-anatomy and neurophysiology and especially the manner in which the evolution of the brain proceeds.

The propaganda for vocational training or education is an important feature of the times. A child who is able to get what is best for him in education should have only one vocation, that of fundamentally educating himself. He should be grounded in the three R's before he thinks of taking vocational flights.

I have seen somewhere that Einstein has recommended that a child in the early stages of his education should be given a lock to observe as a whole and to unravel its component parts. Einstein, in this recommendation, does not wish to make a locksmith of the child but simply to train his powers of observation and comparison. It is with language as with the lock that the child should be trained not only to see and understand words and phrases as a whole, but also he should be taught to dissect them into their component parts —the words into syllables and the syllables into letters.

Among the outgrowths of educational adventure are the manual training school for boys and the department of domestic science for girls. Both of these departures from the old fashioned curriculums are excellent in their way. As all boys cannot be expected to become statesmen, journalists or professors or all girls devotees of art or literature, care must be taken simply to see that the boys in their pursuit with the hammer, jig-saw and lathe, and the girls in their dressmaking and cooking do not forget or overlook the fundamental three R's. One course introduced not long since into the curriculum seemed to have for its object the making of Dickens' doll dressmakers. So much time, however, was assigned to this branch as originally laid out that teachers of fundamental subjects like English properly rebelled.

The question of the methods of promotion in schools of all grades is one of vital importance and deserves the special attention of the neurologist interested in elementary education. In some parts of the West, we are told, pupils and students are passed through all grades from the lowest elementary even to college without any examination tests of their acquirements. This is surely one of the reasons why 75 per cent of our university graduates cannot read or write the English language correctly. Many laymen and educators are closely considering this question. Owen J. Roberts, one of the trustees of Haverford College, and Dr. W. W. Comfort, president of that college, at a recent meeting of the Haverford Alumni expressed their disapproval of methods of promotion by certification instead of rigid examination. This objection is applicable to the methods of promotion from one grade to another in our grammar and high schools. Children are passed on what are called their term averages, which may reflect merely the favoritism of the teacher or the influence exerted by some one outside the school. After the first and second grades, no pupil should be advanced except as the result of a properly conducted examination, and this examination should be held not by the teachers in the grades wishing to advance its pupils, but by principals or teachers of grades to

which they are desired to be advanced. The best method would probably be to have the children examined for promotion by the Director of Research and Result or one of his assistants, so that all collusion or favoritism could be rigidly excluded.

Certainly some credit should be given for good term work, but a larger credit for the results of examinations. On the score of 100 per cent average, 40 per cent would be advisable for term work and 60 per cent for examinations, the advancement average being placed at 70.

As will be evident, I have been chiefly concerned with elaborating and extending the points discussed in Dr. Tilney's address. I have restricted myself to the influence of neurology on elementary education. Starting wrong, a student may never get on the right track.

Neurology affects elementary education successfully in so far as it influences that education in accordance with the natural development of the brain structure and function.

It is the rôle of the neurologist to see that elementary education is so planned and pursued that the education travels hand in hand with what should be the natural order of the evolution of the brain.

STUDIES IN DECEREBRATION

III. THE LABYRINTH *

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In two previous communications [1] it was pointed out that simultaneous ligation of the basilar and carotid arteries produced a decerebrate preparation which was free from the objections of mutilation and shock. The resulting decerebrate rigidity corresponded in all particulars to that obtained by other workers who transected the brain stem.

The present study consists of observations of ten anemic decerebrate cats in which the labyrinths were destroyed. We propose to show that the posture of a caricature of standing assumed by an ordinary decerebrate animal, under certain conditions, may be changed into another lasting posture with the forelegs in flexion, when the labyrinths are destroyed. This is interpreted to mean that the so-called "standing reflex" is but one pattern of increased tone, that may be released from the brain stem. This particular pattern is dependent largely on stimuli which are determined by the position of the head. When the labyrinths are intact there is a predominance of extensor tone to the neck with a resulting extensor position of the legs. When the labyrinths are destroyed and the head becomes flexed as the result of gravity, lasting patterns with the forelegs in flexion may be obtained.

The function of the labyrinths has been identified with muscle tone since the early investigations of Flourens, Goltz, and Ewald. Whereas these earlier investigations dealt chiefly with observations on the general influence of unilateral and bilateral extirpations on tone, coordination, synergy, etc., more recent studies have been concerned with the relation of labyrinthine function to reflex tone. Such studies have been made on normal and decerebrate animals. We owe much of our knowledge of the rigidity of decerebrate animals to Sherrington's [2] accurate observa-

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* Read before the Institute of Medicine of Chicago, Feb. 26, 1926.

* From the Laboratory of Surgical Research, Northwestern University Medical School.

1. Pollock, L. J., and Davis, L. E.: A Method of Decerebration, Arch. Neurol. & Psychiat. **10**:391-398 (Oct.) 1923. An Acute Decerebrate Preparation, ibid. **12**:288-293 (Sept.) 1924.

2. Sherrington: Decerebrate Rigidity and Reflex Coordination of Movements, J. Physiol. **22**:319, 1898.

tions and physiologic interpretations. The labyrinth was considered by Sherrington [3] to be a receptive organ capable of being stimulated by change of position of the head in relation to the horizon, and by movements of the head. By it are excited reflexes which adjust the segment to the horizon line, and other parts, as the extra-ocular muscles, are similarly reflexly adjusted by it. He called attention to the resemblance between the labyrinthine receptors and the proprioceptors of the limbs, in that in both stimulation occurs chiefly through the reaction of the organism itself, and that they both originate and maintain tonic reflexes in the skeletal muscles. Sherrington's [4] observation that movement of the head in relation to the trunk modifies the distribution of extensor tone in the extremities has been fully explained by the extensive and illuminating researches of Magnus and his co-workers. They have shown that the position of the head determines the distribution of tone in the muscles of the neck, trunk and extremities in intact as well as in decerebrate animals. This influence depends on certain reflexes of which two chief groups have been described, the standing reflexes and the righting reflexes.

Magnus [5] described the planes of transection of the brain stem necessary to produce decerebrate rigidity as one bounded dorsally by the posterior limits of the anterior colliculi and ventrally by the region immediately caudad to the corpora mammillaria; caudad the rigidity persisted until the plane of entry of the eighth nerves was passed. As is well known, such an animal retains indefinitely the position imposed on it by passive movement of the head. Although it can stand when carefully balanced, it cannot walk, run, maintain its balance or right itself. The distribution of tone can be temporarily modified by certain phasic reflexes elicited by proper stimuli. The decerebrate rigidity persists after ablation of the cerebellum (Sherrington [6]) and destruction of the labyrinths (Magnus and W. Storm van Leeuwen [7]). When a decerebrate animal's head is immobilized in relation to the body, and is so placed that the vertex is down and the line of the mouth is at an angle of 45 degrees with the horizontal, the rigidity reaches its maximum;

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3. Sherrington: The Integrative Action of the Nervous System, New Haven, Yale University Press, 1923, p. 337.

4. Sherrington: Flexion Reflex of the Limb, Crossed Extension Reflex, and Reflex Stepping and Standing, J. Physiol. **40**:27, 1910.

5. Magnus, R.: Welche Teile des Zentralnervensystems müssen für das Zustandkommen der tonische Hals und Labyrinthreflexe auf die Körpermusculatur vorhanden sein, Arch. f. d. ges. Physiol. **159**:244, 1914.

6. Sherrington: Decerebrate Rigidity and Reflex Coordination of Movements, J. Physiol. **22**:324, 1898.

7. Magnus, R., and Storm van Leeuwen, W.: Die Akuten und die dauernden Folgen des Ausfalles der tonische Hals und Labyrinthreflexe, Pflüger's Arch. f. d. ges. Physiol. **159**:157, 1914.

with the vertex up and the line of the mouth 45 degrees below the horizontal, the rigidity is at its minimum. When the labyrinths are destroyed, change of position of the head in relation to space produces no change in the distribution of tone in the decerebrate animal. Such a change, then, is due to the labyrinthine tonic or standing reflexes.

The labyrinths control the tonus of the muscles of the neck as well as of the extremities (Magnus and de Kleijn [8]). Any position of the head in space which increases the extensor tone in the extremities increases the tone in the extensors of the head as well. Whereas each labyrinth may influence the tone of the extremities of both sides, the influence of the labyrinth on the neck musculature is unilateral. Tonic labyrinthine reflexes may, therefore, influence the tone of the extremities directly, or indirectly, through the neck muscles.

When the labyrinths are destroyed the distribution of tone to the muscles of a decerebrate animal may be modified by the neck tonic or standing reflexes. These reflexes arise in the proprioceptive nerve endings of the cervical muscles and joints. Rotation of the head, and lateral, dorsal and ventral flexion of the head produce constant changes in muscle tone and posture. Rotation of the head with vertex to the right and snout to the left produces an increase of tone in the muscles of the left side. An increase of tone is produced in the side to which the head is laterally bent.

When both labyrinths are destroyed and the posterior roots of the first, second and third cervical nerves are cut, changes of the head in space and in relation to the trunk have no influence on the distribution of tone in a decerebrate animal (Magnus and W. Storm van Leeuwen [7]).

It is obvious that many other postural reflexes must exist in a normal animal other than these two groups of tonic reflexes. When an animal was decerebrated cephalad to the midbrain with or without the thalamus intact, it was found by Magnus [9] that as the animal recovered from shock and ether it gradually assumed a sitting position, and the head was immediately brought into a normal position, closely followed by the trunk. The distribution of tone was normal. Left to itself, such an animal remained motionless but could be stimulated to walk, run and jump. If overturned it righted itself, and in whatever position the animal was placed the head at once assumed the upright, normal posture. The ability to assume and maintain the normal position of the body is dependent on a group of reflexes, the sum total of which is designated as "righting reflexes" (*Stellreflexe*), as opposed to the tonic reflexes grouped together as standing reflexes (*Stehreflexe*). They consist of

8. Magnus, R., and de Kleijn, A.: Die Abhängigkeit des Tonus der Nackenmuskeln von der Kopfstellung, Pflüger's Arch. f. d. ges. Physiol. **147**:403, 1912.

9. Magnus, R.: Beiträge zum Problem der Körperstellung, Pflüger's Arch. f. d. ges. Physiol. **163**:405, 1916.

(1) labyrinthine reflexes acting on the head; (2) postural reflexes arising in the body wall acting on the head through asymmetric stimulation; (3) neck reflexes; (4) postural reflexes acting on the trunk and limb muscles through asymmetric stimulation. With the exception of the neck reflexes their centers are in the midbrain. Following bilateral extirpation of the labyrinths the labyrinthine righting reflexes are destroyed and change of position of the head in relation to space does not produce any modification of tone in the muscles of the neck or body.

The relation of the labyrinth to tone in decerebrate animals may be summarized as follows: Decerebrate rigidity, resulting from a transection of the brain stem below the midbrain, persists unchanged after destruction of the labyrinths. The labyrinths are the receptor organs for righting and standing reflexes by which the distribution of tone is modified by changes of the position of the head in relation to space.

Assuming that the sum total of function of that part of the brain stem remaining after decerebration was expressed in the resulting rigidity in an antigravity position, former workers were largely concerned with attempts to abolish the rigidity by ablations of remaining parts of the nervous system, cerebellum, red nucleus, eighth nerves, etc. If it had been assumed that the antigravity position was but the result of one particular group of numerous reflexes which could be released from the brain stem, the direction of research would have been modified. Beginning with such an assumption, one might speculate that the decerebrate rigidity in a caricature of standing is the simplest reflex pattern which may be released; then if other patterns exist, they either are inhibited or cannot break through the extreme extensor rigidity ordinarily present. Investigation should, then, largely deal with attempts to release other patterns by removal of the remaining parts of the nervous system, which either inhibit them or by a selective influence on extensor tone prevent their appearance. With particular reference to the function of the labyrinth the problem may be stated thus: Do the labyrinths mediate a reflex arc which either selectively reinforces extensor tone, or inhibits certain reflex patterns other than "standing?" It is not concerned with a possible diminution in tone resulting from the destruction of the labyrinths, but rather with the distribution of tone in a particular pattern.

If, as shown by Rademaker,[10] the normal distribution of tone depends on the red nucleus and rubrospinal tracts, the reflexes released from caudad portions of the nervous system can only modify that abnormal distribution of tone to the extent that flexor or extensor hypertonicity is produced.

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10. Rademaker, G. G. J.: Brain **47**:390 (Aug.) 1924.

In the course of some experiments which are uncompleted, we have observed animals in which, under certain conditions, tone seemed to be normally distributed. A lasting attitude of decerebrate rigidity in standing could then be produced at will by proper labyrinthine and neck reflexes.

It was no longer speculative to assume that the decerebrate "standing reflex" was but one of a number of reflex patterns which could be released from the brain stem. In the above-mentioned animals with normally distributed tone, passive extension of the head produced the attitude of decerebrate rigidity which persisted as long as the head was passively fixed in this position. It follows that in the ordinary decerebrate animal some force is concerned with the production of extension of the head with a consequent extensor rigidity of standing. At this point we began our experiments of extirpation of the labyrinths in decerebrate animals.

Attention must be called to certain differences between the preparation resulting from anemic decerebration and that produced by transection of the brain stem. The former method is free from shock and mutilation; there is a sharp demarcation between the anemic and normal tissue; no hemorrhage results; the animal immediately assumes a decerebrate attitude, and numerous reflexes may be elicited immediately following the decerebration. At given levels there appear certain reflexes which, by the method of transection, have been elicited only at higher levels. Among these are alternate automatic movements. This would indicate that in mutilating operations, even if no pathologic change is demonstrable, there is a loss of function at some distance from the transection. Although it is obvious that the method of transection has served adequately to adduce the data contributing to our total knowledge of decerebrate rigidity, and standing and righting reflexes, we feel that it does not follow that this method has permitted the observation of all of the activities of the brain stem, or that other methods, because untried, are needless and faulty.

It is necessary to call attention to the difference in the resulting preparations because it has been stated that following destruction of the labyrinths the decerebrate rigidity remains unaffected; that is, the rigidity is not lessened.

Observations on animals decerebrated by transection and those in which section of the cervical nerves was made in addition, as in some of the experiments of Magnus, are not completely comparable to those made on animals decerebrated by the anemic method.

Ten animals were decerebrated by the anemic method and their labyrinths destroyed intra-orally. At times the decerebration followed

and at times preceded the labyrinthine extirpation. The results were constant in all of the animals.

It may be recalled that in the description of the anemic decerebration, it was noted that the tympanic bullae were uncovered and served as a means of localization. It was a simple matter to enter the bullae with a burr and to expose the petrous portion of the temporal bone in which the labyrinths lie. This part of the bone with the enclosed labyrinth was then destroyed with the burr. This method precluded the possibility of injuring the innervation of the neck muscles. However, in some of the animals the labyrinths were destroyed through an external approach.

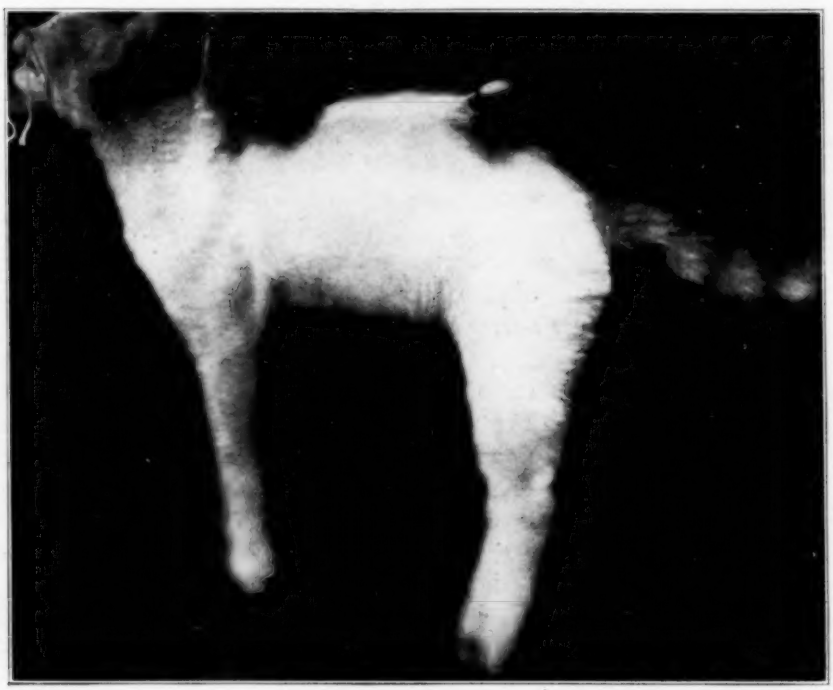

Fig. 1.—Decerebrate animal with labyrinths destroyed and head passively fixed in position of extension.

In such a procedure, an incision was made anterior to the external auditory meatus, and the root of the zygomatic process was exposed. By use of the burr, a trephine opening was made into the petrous portion of the temporal bone, and the destruction was carried on until the labyrinths were completely destroyed.

In all the animals removal of the labyrinths was verified by both gross and microscopic examinations.

On being suspended such an animal assumed a good decerebrate rigidity in fore and hind legs (fig. 1). Shortly afterward the head

began to droop, and the rigidity lessened in the forelegs. When, at this time, the head was passively extended, and suddenly released, it dropped into a position of flexion, and the forelegs were convulsively flexed in all joints, and adducted. At the same time, the hindlegs were more rigidly extended backward (fig. 2). When the head was again passively extended the forelegs assumed an attitude of extension and the tone in the hindlegs was diminished.

From this it would appear that the labyrinths exert a strong influence on the extensor reflex of the neck, which tends to produce a fixed position of the head in extension, with a consequent marked extensor

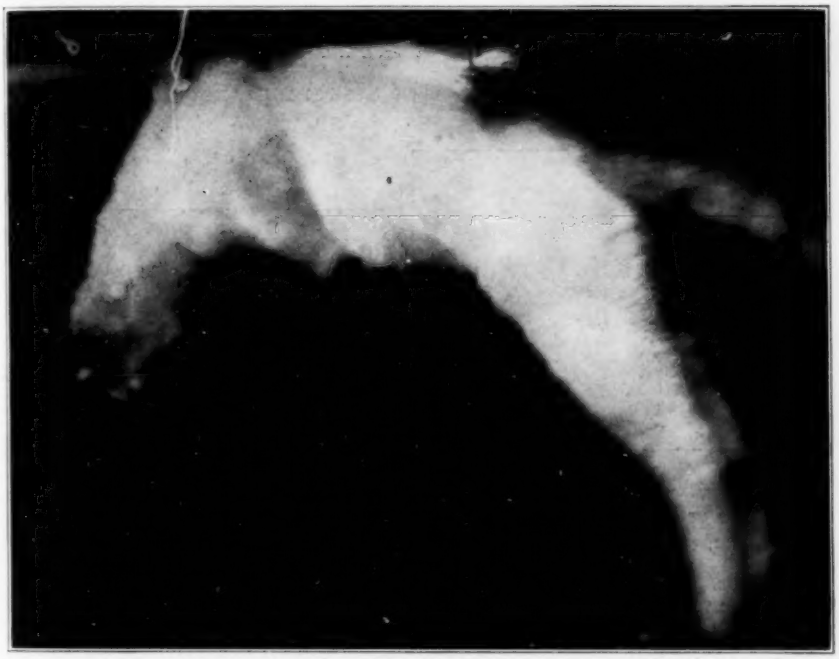

Fig. 2.—Lasting pattern of flexion and adduction of the forelegs when the head is flexed as the result of gravity.

rigidity in the forelegs. Not only does this position evoke an extensor rigidity in the forelegs, but the play of labyrinthine tone on the extensors of the neck alone is sufficient to reinforce the extensors of the forelegs when the head is passively flexed. When the labyrinths are destroyed and the head is suddenly released, marked and sudden flexion occurs as the result of gravity, and the forelegs are flexed and adducted. The rigidity in flexion is as great as the rigidity in extension in the ordinary decerebrate animal. The position of the forelegs in flexion is retained indefinitely until the head is passively extended or some phasic reflex is elicited.

It must be recalled that reflexes affecting the neck are elicited not only from the labyrinths, but from the body as well. If the forelegs of an ordinary decerebrate animal are extended at the shoulder the head is passively extended; if the forelegs are flexed, the head likewise becomes flexed. It follows, therefore, that when, as the result of sudden flexion of the head in a labyrinthless decerebrate animal, the forelegs are flexed and adducted, their position tends to impose on the neck a position of flexion, and as such an animal cannot change the position of its head, the attitude of the forelegs in flexion is lasting. Although it is logical to assume that further investigation will show that this position of the forelegs is produced chiefly through the neck reflexes, it is necessary to point out the difference between the ordinary neck reflex of a decerebrate animal and this lasting pattern of flexion. Diminution of extensor tone, and at times flexion of the forelegs, may be produced by

Fig. 3.—(After Magnus) *A*, decerebrate cat in position of maximum tonic labyrinthine reflex; *B*, after injection of 1.2 mg. per kilogram of picrotoxin the extensor tonus changed to flexor tone.

passive flexion of the head in a decerebrate animal. As soon as pressure is removed from the head it again assumes a position of extension, and the forelegs are again rigidly extended. When the labyrinths are removed, the head spontaneously flexes if its support is suddenly removed, and it does not again spontaneously extend.

Former investigators who have destroyed the labyrinth in decerebrate animals have not noted the occurrence of this lasting reflex. An explanation other than the method of decerebration may be found in the fact that these workers were concerned with the observation of the persistence of extensor rigidity after destruction of the labyrinths, and naturally did not attempt to modify it by searching for other reflexes. It is emphasized that this lasting pattern is elicited constantly only on the sudden dropping of the head from a passively extended position. Whether under such conditions the reflex would appear in an animal decerebrated by transection remains to be seen.

The observations of Jonkhoff [11] on the influence of picrotoxin poisoning on decerebrate rigidity are particularly important in this connection, although his interpretation differs from ours. He found that picrotoxin had the property of reversing the extensor rigidity of a decerebrate animal into a flexor rigidity. Magnus [12] shows an illustration of a decerebrate animal poisoned with picrotoxin. The animal is suspended with the legs down. The head is seen to hang in a flexed position and the forelegs are strongly flexed in all joints (fig. 3). The position of this animal is similar to the lasting flexor attitude which is constantly observed after labyrinthine destruction. Magnus states that large doses of picrotoxin, 1.2 mg. per kilogram or more, destroyed the labyrinthine reflexes. Although he believes that his observations show that picrotoxin produces a reversal of distribution of tone through neck and labyrinthine reflexes in decerebrate and normal animals, we wish to emphasize the observation that tonic labyrinthine reflexes on the extremities were among the earliest to be lost, and that in this respect the experiments with picrotoxin poisoning illustrate the same mechanism as shown in our experiments on destruction of the labyrinths. Removal of extensor reinforcement to the neck and extremities by destruction of the labyrinths or their function permits the release of permanent patterns of flexor rigidity in the forelegs.

After destruction of the labyrinths phasic reflexes could be elicited with greater facility and some were elicited which had not been observed by us in ordinary decerebrate preparations. When the forepaws were grasped and pulled a strong, steady withdrawal was exerted. When the forepaws were pinched, a striking or clawing movement occurred, during which the claws were unsheathed. When the forepaws were flexed and released a stepping forward followed. Running movements were pronounced and frequently were so active that it was difficult to balance the animal so that the position of standing could be imposed.

When the head had been allowed to drop into a flexed position, pressure downward on it produced a reflex extension and a consequent extension of the forelegs into an attitude of ordinary decerebrate rigidity.

It would appear that the labyrinths exert a strong reinforcing action on the extensors of the neck which produce a fixed position of the head and a consequent marked extensor rigidity in the forelegs, which makes it difficult for certain phasic reflexes to appear. When the labyrinths are destroyed these reflexes (striking) may be more readily elicited.

One labyrinth only was destroyed in one animal, after decerebration. It was impossible in this animal to produce the lasting flexor attitude

11. Jonkhoff, D. J.: Beiträge zum Pharmakologie der Körperstellung und der Labyrinthinreflexe. III Mitteilung; Pikrotoxin, Acta oto-laryng. **4**:265, 1922.

12. Magnus, R.: Körperstellung, Berlin, Julius Springer, 1924, p. 68.

of the forelegs. The rigidity in every way resembled an ordinary decerebrate preparation. This is in conformity with the observations of Magnus, that a single labyrinth influences the tone of both sides of the body and extremities.

An abstract of a protocol of one animal is sufficient to illustrate the reactions of all the preparations.

PROTOCOL

ANIMAL 5.—July 14, 1925, the labyrinths were removed by penetrating the bullae from within the oral cavity. The basilar artery was then tied in the usual manner.

2:30 p. m.—The basilar was tied; there was no hemorrhage; the animal was in good condition. It was placed on the floor. Sneeze, pinna reflexes present. No corneal reflexes.

2:50 p. m.—The animal moved the legs but rolled from side to side; it had no control over the head; the chin struck the floor; it could not stand up There was perfectly normal muscle tone. The animal moved forward in a sliding attitude. The head ploughed along the floor. It rolled from side to side. Progression movements and walking movements were present in legs. When held in midline the animal could pull itself along the floor, although the head and chin were on the floor. It could not raise the chin.

3:00 p. m.—The animal then showed movements like a previous animal did; that is, progression laterally and forward. The head and chin were held close to the floor. It rolled over and over. The head struck the floor violently.

3:05 p. m.—The carotid arteries were tied. There was an immediate assumption of rigidity. The respirations were slowed. The animal was lying on its back. The sneeze and pinna reflexes were normal. The withdrawal reflexes were brisk.

3:15 p. m.—The animal relaxed and then reassumed decerebrate rigidity. The animal was suspended on a frame in the usual manner. All reflexes were active. There was a typical decerebrate attitude. Crossed reflexes were elicited. The head was passively flexed; rigidity was reduced. The tail showed good rigidity. Touching the cornea elicited no lid reflex but the eyeball was retracted and the nictitating membrane moved. The head was suddenly released from suspension and dropped into flexion, and the animal doubled up into a ball and was very rigid in flexion in the forelegs with extension of the hindlegs. The forelegs were held close to body. The head was now passively extended and the animal assumed the former orthodox attitude. Running movements were produced by pinching of the forepaws.

3:25 p. m.—The head was again released. The forelegs were again flexed. Pinching of the ears started running movements. If the neck was passively, gently flexed, the neck muscles contracted, the head was pushed up, and the forelegs assumed extensor rigidity. If untouched, the chin dropped on the chest and the forelegs were held in flexion close to the body indefinitely.

5:00 p. m.—The animal was killed. The head was removed from the body for study of the labyrinths.

CONCLUSIONS

1. The labyrinths exert a strong reinforcement of extensor tone to the muscles of the neck, which produces both a fixed position of the head in extension and a constant play of impulses to the extensor muscles even if the head be passively flexed. As a result, the forelegs assume an attitude of strong extensor rigidity in a decerebrate animal.

2. When the labyrinths are destroyed in a decerebrate animal and the head is allowed to drop from a position of extension, a lasting pattern of flexor rigidity is produced in the forelegs. The rigidity in flexion is as great as the extensor rigidity of an ordinary decerebrate animal. It can be modified by phasic reflexes.

3. When the labyrinths are destroyed in a decerebrate animal, the position of flexion of the head increases the extensor rigidity of the hindlegs. Passive extension of the head reduces this rigidity, but the hindlegs are always in a position of extensor rigidity. Therefore, the extensor rigidity of the hindlegs is mediated chiefly through the body reflexes.

4. The labyrinths produce a reinforcement to the extensor muscles of the neck and body with a consequent rigidity in the forelegs so great as to prevent the appearance of certain phasic reflexes (striking, clawing).

5. A single labyrinth exerts its influence bilaterally to the muscles of the body and the extremities.

STUDIES ON THE CENTRAL VISUAL CONNECTIONS

III. THE GENERAL RELATIONSHIPS BETWEEN THE EXTERNAL GENICULATE BODY, OPTIC RADIATION AND VISUAL CORTEX IN MAN: REPORT OF TWO CASES *

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Until within a decade it could still be considered an open question whether the visual center was limited to a definite portion of the occipital lobe, and whether there existed a projection of the retinal quadrants on the corpus geniculatum and cortex. The affirmative of these two propositions, defended for forty years by Henschen [1] and his followers, such as Wilbrand [2] and Lenz,[3] was for a long time vigorously attacked by the "decentralist" school, under the able leadership of von Monakow.[4] But the experiments of Minkowski [5] in von Monakow's own laboratory appear to have reconciled the two schools, and the general conception of a definite anatomic projection of the retinal quadrants and the macular region on a sharply limited area of the occipital cortex is now generally admitted.

Another question, which has been often asked and answered in various ways, is: What is the localization of the projection of the upper and lower retinal quadrants, the macula and the periphery of the visual field in the primary centers and in the area striata? Many attempts have been made to solve this problem by the obvious method of necropsies on patients who have shown quadrantic field defects. But while a large number of such cases fit well into one scheme of localization (Lenz [3]), others appear contradictory or open to other interpretations (Brouwer [6]).

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* From the Neurological Laboratory of the Binnengasthuis, and the Central Institute for Brain Research, Amsterdam.

1. Henschen, S.: On the Value of the Discovery of the Visual Center, Scand. Scient. Rev. **3**:10-63, 1924.

2. Wilbrand and Saenger: Die Neurologie des Auges, vol. 7, Wiesbaden, 1917.

3. Lenz, G.: Zur Pathologie der zerebralen Sehbahn unter besonderer Berücksichtigung ihrer Ergebnisse für die Anatomie und Physiologie, Arch. f. Ophth. **72**:1-85, 197-273, 1909.

4. Von Monakow, C.: Gehirnpathologie, ed. 2, Vienna, 1905.

5. Minkowski, M.: Experimentelle Untersuchungen über die Beziehungen der Grosshirnrinde und der Netzhaut zu den primären optischen Zentren, besonders zum Corpus geniculatum externum, Arb. a. d. hirnanat. Inst. in Zürich **7**:255-362, 1913.

6. Brouwer, B.: Ueber die Sehstrahlung des Menschen, Monatschr. f. Psychiat. u. Neurol. **41**:129-158, 203-234, 1917.

This is doubtless due, not to an error in the principle of projection, but to the limitations of the perimeter. Every one who is accustomed to the use of this invaluable but treacherous instrument knows how easily scotomas may be overlooked, and how inconstant fixation may prevent the discovery of small areas of retained peripheral vision. This is especially true in patients moribund from a cerebral lesion. How large lesions of the visual cortex may be, and still escape careful and expert perimetry, is shown by the cases of Henschen [7] and of Lenz.[8]

A surer path of investigation is opened to us by Rönne's report [9] on cases of toxic macular scotoma in man, and by the studies of Brouwer and Zeeman [10] on the lesions produced in the corpus geniculatum externum by the destruction of various portions of the retina of the ape. The possibility of a detailed and complete determination of the localization of the retinal quadrants on the cortex by means of small extirpations of the area striata has been shown by Minkowski for cats,[5] and by experiments performed at this laboratory for rabbits [11]; and doubtless a study of pathologic material can be made to yield similar information. Attempts have been made long since to fit together the links of the visual system in such a manner, especially by Henschen, but most of them have been unsatisfactory for various reasons, perhaps chiefly on account of the lack of precise information as to the size and position of the geniculocortical radiation.

The question of the location, size and course of this essential link in the chain appears, therefore, to be the first problem which demands attention. It was supposed at one time by von Monakow that it occupied the stratum sagittale internum; later, that part of its fibers ran in the stratum sagittale externum (inferior longitudinal fasciculus) also; by Flechsig that it ran in the latter alone, and by Henschen that it lay in the fasciculus longitudinalis inferior, but occupied only a fraction of it. If the location and extent of the geniculostriate radiation can be definitely determined and if it can be shown anatomically what portions of it serve to connect the respective portions of the visual cortex with the

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7. Henschen, S.: Klinische und anatomische Beiträge zur Pathologie des Gehirns, vol. 2, 1893, case 44, Louisa Berg.

8. Lenz, G.: Zwei Sektions von Fälle doppelseitige zentraler Farbenhemianopsie, Ztschr. f. d. ges. Neurol. u. Psychiat. **73**:135-186, 1921.

9. Rönne, H.: Ueber doppelseitige Hemianopsie mit erhaltene Makula, Klin. Monatsbl. f. Augenh. **53**:470-487, 1914.

10. Brouwer, B., and Zeeman, W.: Experimental Anatomical Investigations Concerning the Projection of the Retina on the Primary Optic Centers in Apes, J. Neurol. & Psychopath. **6**:1-10, 1925; The Projection of the Retina in the Primary Optic Neuron in Monkeys, Brain **49**:1-36 (March) 1926.

11. Putnam, T., and Putnam, I.: Studies on the Central Visual System: 1. The Projection of the Retina on the Striate Cortex of the Rabbit, Arch. Neurol. & Psychiat. **16**:1 (July) 1926.

primary visual centers, we shall at once gain a scheme which may make it possible to harmonize the results of different investigations which at present appear incompatible. In addition, we may be able to form some idea of the proportionate spatial relationships between different portions of the central visual apparatus.

I may begin consideration of the question with the following two cases which were assigned to me for study by Professor Brouwer.

REPORT OF CASES

Case 1.—J. Holman, a man, aged 71, was admitted to the Binnengasthuis, under charge of Prof. Wertheim Salmonson, July 22, 1921, on account of having had a sudden right-sided paralysis while walking in the street the day before. He was unable to talk intelligibly and a brief history was taken from his married daughter. She stated that he had had a similar but slighter attack a year previously, with complete aphasia, but that he had returned to his normal condition after a few days. He was then apparently in good health up to the day before admission. He was not unconscious, and showed no motor or psychic disturbance. He could walk with support. The previous, marital and family histories revealed nothing of importance for the present study. There was no suggestion of syphilis in the history. The patient was a constant but moderate gin drinker.

General Physical Examination.—The patient was senile and did not appear sick. The intellect was unimpaired. There was evident arteriosclerosis and hypertension. The pulse rate was 66, irregular, with many missed beats. The heart was enlarged, with a diastolic murmur. The systolic blood pressure was 180 mm.

Neurologic Examination.—Motor sphere: There was a complete right facial paralysis. The muscles of the right arm were shown to be atrophic by measurement. Only slight flexion of the lower arm was possible; there was rigidity to passive movements. The right leg was hypotonic and weak, but could perform its full range of movements.

Sensory sphere: No subjective disturbance was present. There was a questionable right hemihypesthesia. No visual or auditory disturbances were made out.

Coordination: There was no incoordination of the left arm or leg. The right side could not be tested. The patient was unable to stand alone.

Reflexes: Pupillary and corneal reflexes were present. The abdominal reflex was abolished on the right. The arm reflexes and knee jerk were exaggerated on the right, and there was ankle clonus and a positive Babinski reflex.

Aphasia: The patient had a motor and conduction aphasia. He could say "doctor," "nurse," etc., but was otherwise unintelligible. He was unable to repeat words, and showed some paraphasia. He could execute commands. There was some perseveration. Inner speech, and reading and comprehension of words persisted. Writing could not be tested.

Course.—The patient's speech gradually improved at first, but spontaneous speech never returned. He began to write with his left hand. The visual fields were taken roughly in February, 1922, and no hemianopia was found.

In July, 1922, the patient had several arteriosclerotic attacks with complete loss of consciousness. The visual acuity was decreased so that the patient could scarcely count fingers at 3 meters. No changes were seen in the fundus.

The general condition then improved, but vision continued to fail. In March, 1923, left hemianopia was discovered; but the patient's condition made it impos-

sible to chart the fields accurately, and it is not even certain whether the macula was spared.

He continued to have arteriosclerotic attacks every few months. No change was noted in the general condition or in the neurologic signs. The hemianopia continued. The patient developed fever and whistling râles in August, 1924, and died August 8. The cause of death was given as cerebral thrombosis with subcortical motor aphasia.

Necropsy.—The postmortem observations were kindly given us by Professor de Vries, the necropsy having been performed by Dr. J. Elle. The general anatomic diagnoses are as follows: myocarditis fibrosa; ventricular thrombus; chronic pleuritis; croupous pneumonia of the left lower lobe; mucopurulent bronchitis; splenic atrophy; carcinoma of the stomach with metastases in the para-aortal lymph nodes; brown atrophy of the liver with passive congestion; primary sclerosis of the kidneys; atheroma of the aorta with thrombus formation, and of the splenic artery; encephalomalacia. The pathologic changes in the remainder of the body had no evident relation to the condition of the brain, to which we may now turn our attention.

MACROSCOPIC OBSERVATIONS

The brain weighed 1,250 Gm. It was removed intact, and immersed with the dura in a 10 per cent solution of formaldehyde. When properly hardened, it was examined and cut by Professor Brouwer, who made the following note:

"Specimen *B*132. Marked arteriosclerosis of the basal vessels. The cortex appears to be in good condition except at the foot of the postcentral and precentral convolutions. It is certain that Broca's area is intact. The focus begins about the lower third of the sulcus of Rolando and increases very rapidly so that the foot of the precentral and postcentral convolutions are entirely destroyed. There is no other large focus to be seen, except in the right cuneus, which will be described later. The pathologic part is colored a reddish brown as in thrombosis cerebri. The area of Wernicke (T_1) is well preserved. There are no anomalies of the sulci and gyri.

"In cutting the brain it is made certain that the area of Broca is macroscopically free. The only lesion of the frontal brain is a very small focus in the lower part of the third frontal convolution, above the sylvian fossa. This small lesion is in direct contact with the lesion of the anterior central gyrus. There is no hydrocephalus. No other focus is present in this region. The section lies a little frontal to the tip of the temporal lobe.

"The next section shows that the lesion is large, lying in the inferior part of the precentral gyrus, and also destroying the white matter of the first and second frontal convolutions. The focus extends to the top of the internal capsule, so that the entire projection system must be damaged. The section is at the level of fig. 41, p. 45, of Monakow.

"The third section is taken through the pulvinar. In this block the corpus geniculatum externum is seen. There is still a large focus in the deeper layers of Ca and Cp, which extends further caudad also. The focus approaches the ventricle, but does not open into it.

"The right occipital lobe shows a large lesion involving the entire mesial surface, with the exception of the extreme tip. The convexity is normal. A cut made through the anterior end of the cuneus shows that the lesion approaches the ventricle but does not enter it. Nothing is seen of the stripe of Gennari.

"The left occipital lobe appears normal on section."

Complete serial sections were cut frontally through both occipital lobes and through the thalamus, including the corpora quadrigemina anterior and the corpora

geniculata externa. The blocks were embedded in celloidin, cut 35 microns thick, and alternate sections were stained by the Weigert-Pal and the van Gieson methods.

MICROSCOPIC OBSERVATIONS

The Left Hemisphere.—The occipital lobe, inferior longitudinal fasciculus, and external geniculate body are free from degeneration. These structures stand out with particular distinctness because the enormous lesion in the frontoparietal white matter has caused an almost complete degeneration of the white matter of the parietal and temporal lobes, and a marked paling of the occipital lobe, with the exception of the structures just named. A portion of this lesion is shown in figure 1 and it requires no further description here. A wax-plate reconstruction was made of the isolated stalk of the corpus geniculatum, which will be described in a later paper of this series. The volume of the corpus geniculatum was estimated at 0.0773 cc.

Fig. 1 (case 1).—Left hemisphere: frontal section, passing through corpus geniculatum externum (*c.g.e.*); the extensive lesion (*L.*) of the internal capsule is seen above at the left; the fasciculus longitudinalis inferior (*f.l.i.*, outlined in white) stands out prominently, intact on a partially degenerated background. The thinning of the stratum sagittale internum may be noted. Weigert-Pal stain. Photograph; × 3.

The Right Hemisphere.—A virtual reconstruction (fig. 2) shows the extent of the lesion in the right occipital lobe. In sections from the extreme tip, the stripe of Gennari is seen to be small, and limited to the mesial surface of the hemisphere. Even in the most posterior section a small area of malacia is seen in the upper half of the striate region (fig. 3). There is some diffuse paling of the white matter about it. The area of malacia increases in size more rapidly than does the striate cortex and in a section 5 mm. from the pole the upper end of the stripe is lost in a malacic cavity. The last remains of the stripe—its inferior extremity—are seen in a section 10 mm. from the occipital pole (fig. 4). The total area of cortex which is spared, as determined by a method to be described in a later paper, measures 1.38 sq. cm. The cyst has grown larger, but a substantial band of fibers connects the surviving cortex with the central white matter

which is well preserved. As we approach the posterior horn of the ventricle (fig. 5, 18 mm. from the occipital pole), a tiny strip of the striate cortex appears but in this and all succeeding sections it is completely isolated from the medulla. It is striking that layer IV of Brodmann (the stripe itself) persists, while most of the radial fibers have degenerated. At this point the strata sagittalia can barely be made out; they are both about equally degenerated, but less so than is the case farther forward.

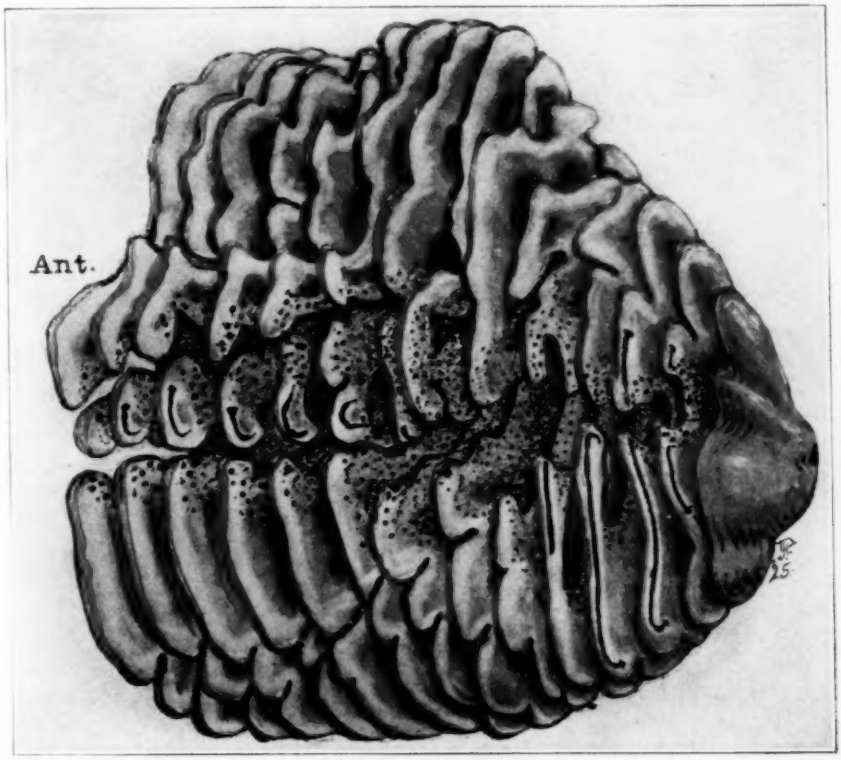

Fig. 2 (case 1).—Right occipital lobe seen from the mesial side and posterior end: sections taken at definite intervals are drawn as if supported in their normal positions (method of drawing may be found in Putnam, T. J., and Putnam, I. K.: Studies on the Central Visual System. I. The Anatomic Projection of the Retinal Quadrants on the Striate Cortex of the Rabbit, Arch. Neurol. & Psychiat. **16:**1 [July] 1926); the stripe of Gennari is drawn in black; degenerated and atrophic areas are stippled in black and white; the remains of the striate cortex are in communication with the white matter; a small "island" of cortex persists anteriorly, but is completely isolated; it is impossible to identify all of the calcarine fissure with accuracy. Camera lucida drawing, × 3.

When the occipital horn is reached, the cyst is seen to lie along its medial aspect, separated from it only by a thin membrane. The walls of the cyst have fallen together, so that the entire lobe is shrunken (fig. 6, 32 mm. from pole). Of the white matter surrounding the ventricle, the tapetum is perfectly preserved.

Fig. 3 (case 1).—Section 3 mm. anterior to tip of right occipital lobe: the beginning of the lesion (*L.*) is seen near the upper part of the striate cortex. Weigert-Pal. Photograph, × 3. (This and the succeeding photographs in case 1 are shown as if viewed from the front.)

Fig. 4 (case 1).—Section 10 mm. anterior to tip of occipital lobe: the lesion (*L.*) has increased in size; the last remains of the striate cortex in connection with the white matter appears; the extreme tip of the ventricle (*Vent.*) is seen, and the sagittal strata are forming about it. Weigert-Pal. Photograph; × 3.

Fig. 5 (case 1).—Section 18 mm. from tip of right occipital lobe: the lesion has completely isolated a tiny strip of striate cortex (*a.s.*); the sagittal strata are distinct. Weigert-Pal. Photograph; × 3.

Fig. 6 (case 1).—Section 32 mm. from right occipital pole: the lesion has reached its greatest extent; its walls are collapsed; the ventricle (*Vent.*) is dilated; about it are seen the stratum sagittale internum (*s.s.i.*) and fasciculus longitudinalis inferior (*f.l.i.*); the last remains of the area striata (*a.s.*) are quite cut off from the white matter. Wiegert-Pal. Photograph; × 3.

Both the strata sagittalia are the seat of marked degeneration, which is on the whole diffuse, but the ends of both have suffered more than the middle portion. The inferior longitudinal fasciculus (stratum sagittale externum) shows about the same grade of degeneration as the stratum sagittale internum at the posterior end of the ventricle. The latter, however, comes to contain more and more normal fibers as the corpus geniculatum is approached, while the former remains about the same tint throughout its course. The new fibers in the stratum sagittale internum mostly lie along its inner surface.

The cyst extends only a few millimeters anterior to the cuneus. No further primary foci are found in the visual pathway. As the level of the posterior end of the corpus geniculatum externum is reached (fig. 7) white streaks of degeneration are seen stretching from the inferior longitudinal fasciculus, and perhaps also from the stratum sagittale internum, toward the triangular field of Wernicke. Their exact course is obscured by a mass of fibers about the "tail" of the caudate nucleus.

Fig. 7 (case 1).—Sections through posterior end of right corpus geniculatum externum (*c.g.e.*); both strata sagittalia are about equally and diffusely degenerated; paling of Wernicke's field. Weigert-Pal. Photograph; × 3.

In the first sections through the corpus geniculatum, about the lower (lateral) half of the ganglion is degenerated (fig. 8). Passing forward, the proportion of the area degenerated increases, but about 3 mm. from the posterior end the persisting normal tissue occupies about a third of the mesial portion (including most of the body). There is also a small normal area in the tip of the temporal horn. All of the anterior two thirds of the ganglion is degenerated (figs. 9, 10 and 11). A general view of the ganglion is given in a virtual reconstruction (fig. 9). The degeneration is nowhere quite complete. A few of the largest cells (the "ventrale Krantz" of von Monakow) persist little changed, and even some of the medium-sized cells in the upper layers are to be seen, although shrunken and pyknotic. There is an increase of glia everywhere, new vessels are seen, and the tissue is much shrunken (fig. 11 should be compared with fig. 12).

The right optic tract appears slightly smaller than the left. No changes are made out in the corpora quadrigemina anterior.

CASE 2.—At the Central Institute for Brain-Research, Amsterdam, there is a complete set of serial sections extending through the occipital and parietal lobes of a brain in which there was a vascular lesion of the occipitotemporal region. This series was cut in the course of another investigation, but was never reported. No clinical details of the case are known. Sections through the occipital lobes are stained by the Weigert-Pal method; those through the corpus geniculatum by that of van Gieson.

Only one lesion is present in the portion of the brain available for study. This is a large apoplectic cyst lying on the lateral surface of the brain in the occipitoparietal region. An idea of its relations may be gained from figures 14 and 15. For the present purpose, a description of the effect of the lesion on the central visual system will suffice.

Fig. 8 (case 1).—Section at approximately the same level as in figure 7, through corpus geniculatum; arrows point to the degenerated lateral (lower) half filled with glia nuclei. Carmine. Photograph; × 80.

The striate cortex extends some distance on the lateral surface of the hemisphere (fig. 15). Because of a slight deficiency of data as to number and thickness of sections, it could not be accurately measured. It is nowhere encroached on by the lesion and appears structurally intact (in thick sections).

In the most posterior section, some paling of the white matter is to be seen. As soon as the strata sagittalia can be recognized, it is evident that the upper half (vertical limb) of each is degenerated, but the distinction between the dark-staining half and the almost white half is more clean-cut and definite in the inferior longitudinal fasciculus than in the stratum sagittale internum, which is diffusely pale, though darker below than above. The division between the normal and the degenerated portion of the inferior longitudinal fasciculus becomes more

and more sharp (fig. 13) until we reach the level of the cyst, which severs all the fibers lateral to the ventricle leaving only the tapetum intact (fig. 14). The inferior (horizontal) normal half of the inferior longitudinal fasciculus can be followed beneath it into the temporal lobe, where the inferior limb of the stratum sagittale internum is somewhat degenerated (fig. 15). The cyst extends anteriorly almost to the level of the corpus geniculatum externum. But the persisting ventral portion of the inferior longitudinal fasciculus can be traced beyond it, and eventu-

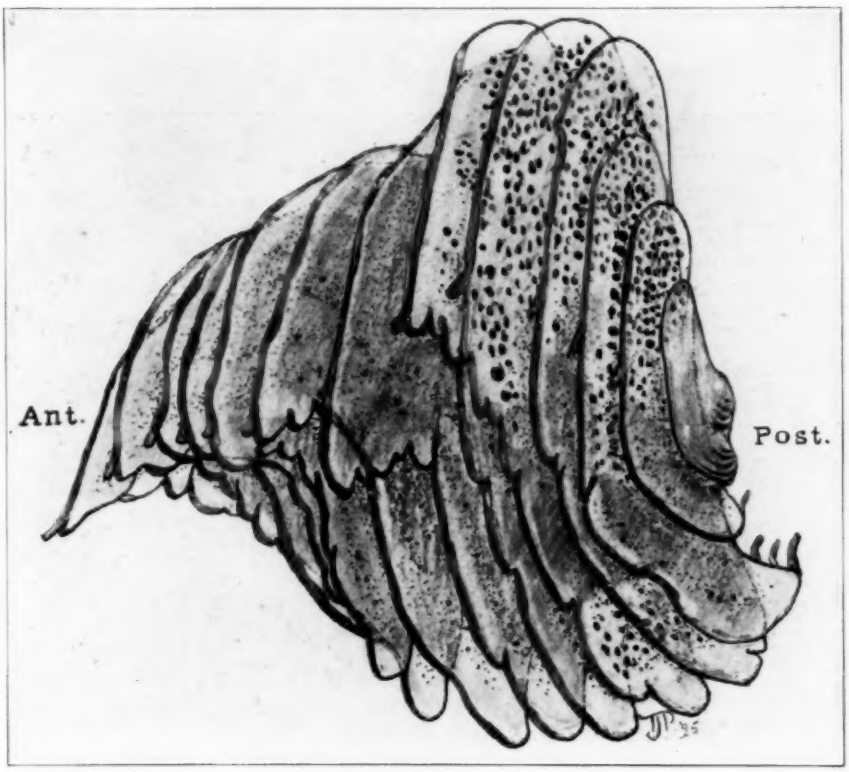

Fig. 9 (case 1).—Virtual reconstruction of right corpus geniculatum externum, viewed from its mesial and posterior aspect: the degenerated area is shaded and finely stippled (to suggest increase in glia); the cells of the normal areas are indicated in black on a light background. Camera lucida drawing; × 80.

ally curves upward in front of it to be lost in a mass of fibers seen in cross-section lateral to the corpus geniculatum. Unfortunately, the appearance of this level cannot well be reproduced, as only van Gieson sections are available.

A virtual reconstruction of the corpus geniculatum is shown in figure 16. No degeneration is seen in the most posterior sections, which represent only the temporal horn of the nucleus. As soon as the body is reached, a degenerated zone is seen, which involves about the mesial third of it (the side toward the spectator in the diagram). It continues to occupy about the same proportion of the cross-section throughout the rest of the nucleus.

Closer study shows that the degeneration is almost complete in the upper layers of cells, but that perhaps a third of the large ventral cells persist, as in case 1. There is an overgrowth of glia cells and new vessels. The atrophic portion is shrunken. The boundary between the degenerated and the normal portion is not sharp; an increase of glia is seen to extend almost to the center of the nucleus (fig. 17).

SUMMARY OF ANATOMIC OBSERVATIONS IN THE TWO CASES

In case 1 a large vascular lesion is seen in the region of the internal capsule, on the left, which has produced a marked paling of all of the

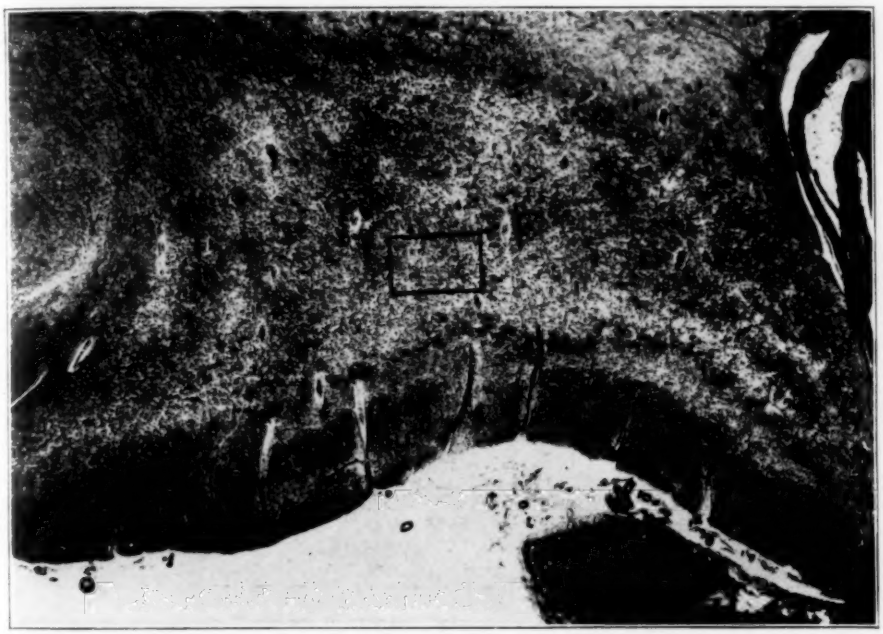

Fig. 10 (case 1).—Section through middle of right corpus geniculatum, showing generalized partial degeneration and gliosis: about a third of the large ventral row of cells, and a few of the smaller cells persist. Carmine. Photograph; ×80. Enclosed area shown in next figure.

parietal, temporal and occipital white matter on that side, with the exception of the inferior longitudinal fasciculus, which retains its distinctive normal histology. No degeneration is seen in the striate cortex or the corpus geniculatum.

On the right there is an extensive lesion of the mesial surface of the occipital lobe, nowhere, however, extending lateral to the ventricle. Most of the area striata is destroyed, but a small portion of it—certainly less than one tenth—is preserved at the tip of the occipital lobe. Both strata sagittalia are diffusely degenerated. They are nowhere touched by

a primary focus. The external geniculate body is entirely degenerated, except for a small portion posteriorly.

In case 2, the only lesion present is a large apoplectic cyst, on the lateral aspect of the occipital lobe, which has destroyed the upper half of both strata sagittalia. The lower half (horizontal limb) of the inferior longitudinal fasciculus can be followed from the level of the tip of the posterior horn of the ventricle posteriorly to the anterior end of the external geniculate body anteriorly, and is everywhere intact. The

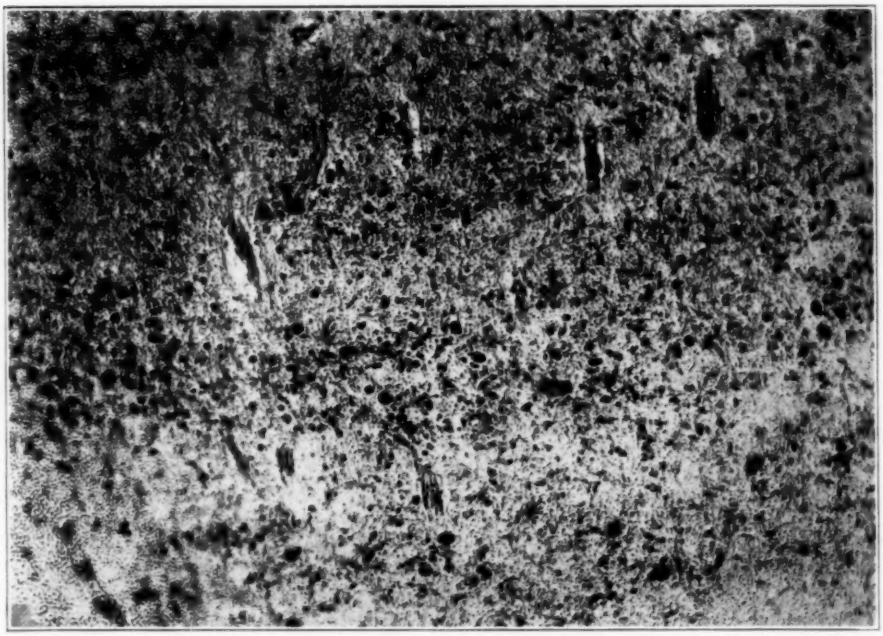

Fig. 11 (case 1).—Enclosed area from figure 10, enlarged: vascularity, gliosis and loss of cells may be noted; the large cells are conspicuous, but close inspection shows that some medium-sized cells persist also. Carmine. × 300.

mesial third (or a little more) of the external geniculate body is degenerated to about an equal extent anteriorly and posteriorly. The striate cortex is intact.

THE LOCATION OF THE OPTIC RADIATION

The isolated condition of the inferior longitudinal fasciculus in the left hemisphere in case 1 brings us at once to a consideration of the evidence which has already accumulated to indicate that this tract represents the optic radiation entirely and exclusively. The large lesion (fig. 1) had severed practically all longitudinal fibers anterior to the "temporal knee" of the tract in question, but the tract itself was, nevertheless, perfectly free from degeneration. It therefore cannot contain

fibers destined for the temporal lobe. The stratum sagittale internum, on the other hand, was markedly degenerated, especially anteriorly, although there was no lesion posterior to the corpus geniculatum externum. So the stratum sagittale internum must contain many fibers running to the temporal or parietal lobes or the basal nuclei. The large dark fibers of the inferior longitudinal fasciculus could easily be traced into the corpus geniculatum; the few remaining fibers of the stratum sagittale internum could not be followed there.

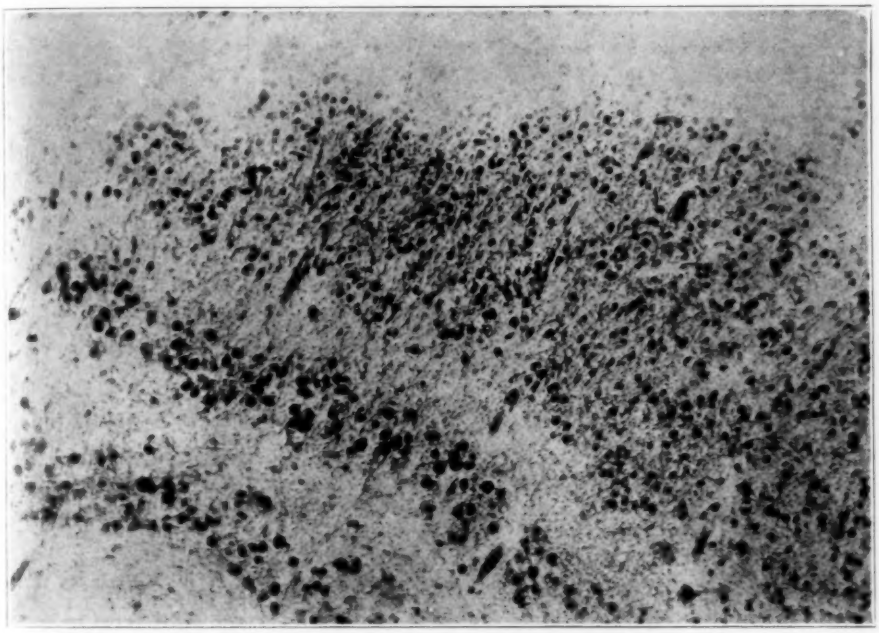

Fig. 12.—A similar area from the left corpus geniculatum, for comparison with figure 11: two rows of large cells may be seen at the bottom of the photograph. Carmine. × 300.

Many similar cases have already been published by Archambault,[12] Meyer,[13] van Valkenburg,[14] Niessl von Mayendorf [15] and others. They

12. Archambault, La Salle: The Inferior Longitudinal Bundle and the Geniculo-Calcarine Fasciculus, Albany M. J., January, 1909, pp. 118-142.

13. Meyer, Adolf: The Connections of the Occipital Lobes and the Present Status of Cerebral Visual Affections, Tr. A. Am. Phys. 1907, pp. 1-10.

14.. Van Valkenburg, C.: Contribution à l'étude de la constitution de la substance blanche temporo-occipitale de l'homme, Psychiat. en Neurol. Bl., 1911, nos. 4 and 5, pp. 1-27.

15. Niessl von Mayendorf: Ueber den Ursprung und Verlauf der basalen Züge des unteren Längsbundels, Arch. f. Psychiat. u. Neurol. **61**:273-327, 1919.

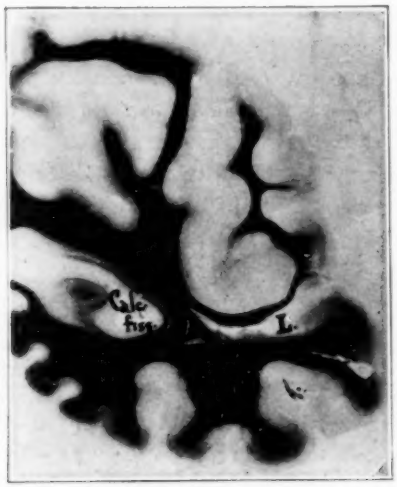

Fig. 13 (case 2).—Section from the right occipital lobe, at the level of the tip of the posterior horn of the ventricle: the calcarine fissure (*calc. fiss.*) is seen at the left; the most posterior portion of the lesion (*L.*) appears at the right. The upper (vertical) halves of the strata sagittalia are degenerated, and the lower half of the stratum sagittale internum is pale; the horizontal limb of the fasciculus longitudinalis is intact. There is no degeneration of the tapetum. Weigert-Pal. Photograph; × 3.

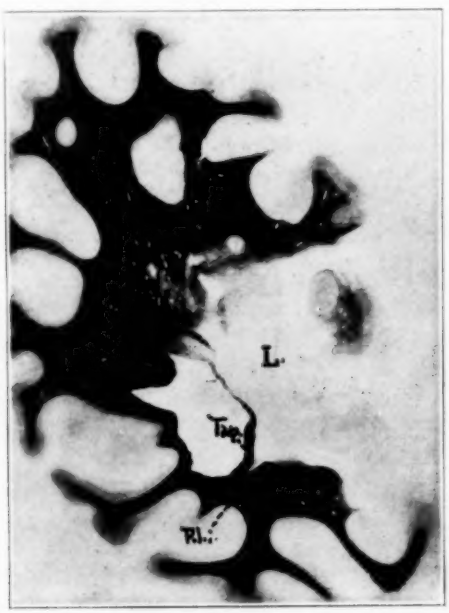

Fig. 14 (case 2).—Section anterior to calcarine fissure: the lesion (*L*) has reached its greatest extent; the tapetum (*Tap.*) and horizontal limb of the fasciculus longitudinalis inferior (*F.l.i.*) remain intact. Weigert-Pal. Photograph; × 3.

resemble each other closely. There appear to be no cases in which a degeneration anterior to the "temporal knee" has caused a lesion of the inferior longitudinal fasciculus; or where a lesion of the fasciculus has occurred without producing partial atrophy of the geniculate body; or of a lesion of the striate cortex or geniculate body without degeneration of the inferior longitudinal fasciculus (under appropriate conditions).

Other reasons for believing that the inferior longitudinal fasciculus represents the geniculocortical pathway have been reviewed in a paper

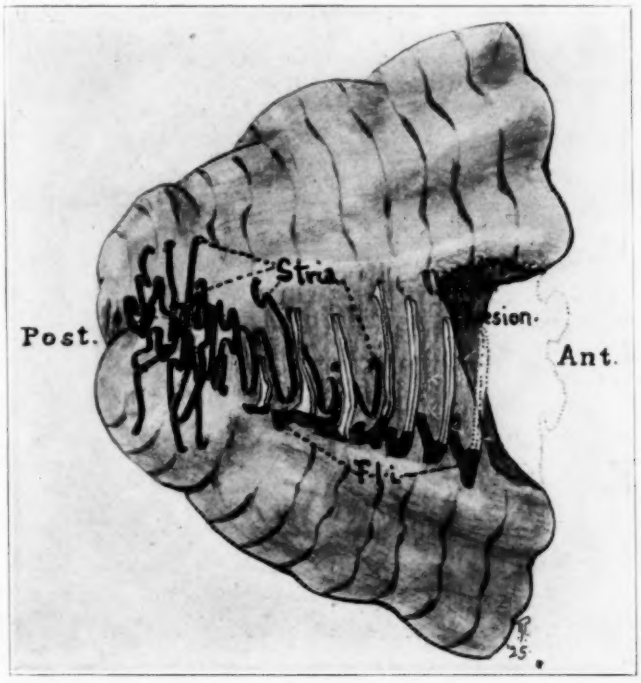

Fig. 15 (case 2).—Virtual reconstruction of the right occipital lobe, viewed from the lateral side: the stripe of Gennari (*stria*), which extends to the lateral surface of the brain, is shown in black; normal horizontal (inferior) limb of the fasciculus inferior (*F.l.i.*) is shown heavily shaded; the degenerated dorsal limb is shown in white; both can be followed from the middle of the striate cortex to the level of the lesion; camera lucida drawing of area striata, fasciculus longitudinalis and cyst; the occipital lobe is schematized. × 3.

of this series devoted to the comparative anatomic aspect of the problem.[16] It was shown that in some animals (apes, carnivora) coarse

16. Putnam, T.: Studies: II. A Comparative Study of the Form of the Geniculostriate Visual System in Mammals, Arch. Neurol. & Psychiat. **16**:285 (Sept.) 1926.

fibers could be traced from the inferior longitudinal fasciculus, but not from the stratum sagittale internum, into the striate cortex. It was also shown that in other animals (seal, porpoise, elephant) the distinctive inferior longitudinal fasciculus alone could be traced into the corpus geniculatum, far removed from the peduncular tracts, and without sending any branches to the temporal or parietal lobes.

In addition, the distinctive histology of the fasciculus—like that of the great somatic motor and sensory tracts, and the optic tract itself, but

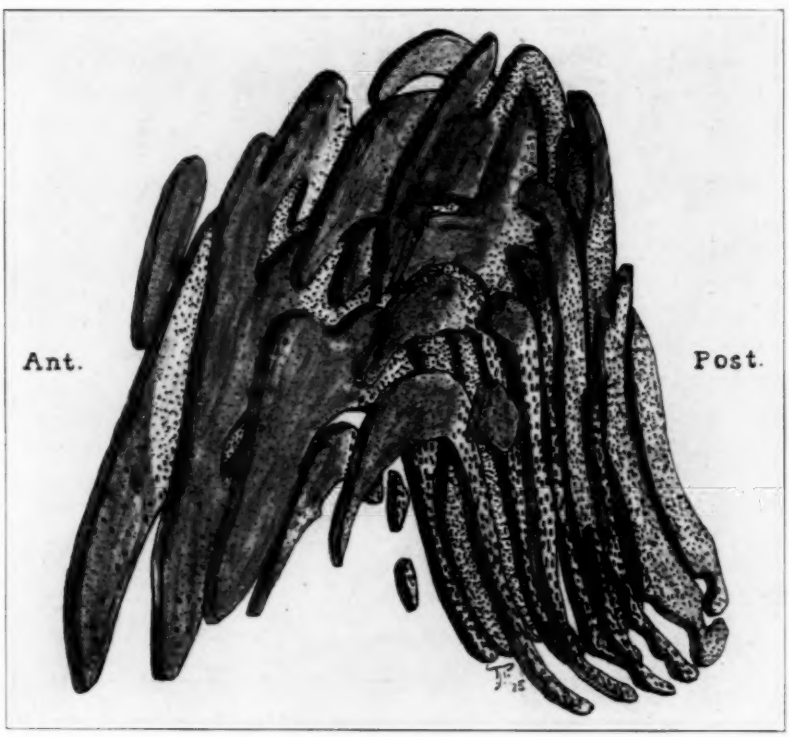

Fig. 16 (case 2).—Virtual reconstruction of the right external geniculate body, viewed from the mesial and posterior aspect: only the gray matter is shown; the degenerated areas are shaded and finely stippled to suggest gliosis; the lateral normal portion is lighter, with nuclei in black; in each section, the proportion of degenerated to normal tissue is constant, except in the most posterior part, which is free from degeneration. Camera lucida drawing; × 80.

quite different from any proved association system—was held to be an additional reason for believing it a projection system. This appearance was pointed out by Sachs [17] some years ago.

17. Sachs, H.: Das Gehirn des Foersterschen Rindenblinden, Arb. a. d. psychiat. Klin. in Bresl. **2**:53-104, 1895.

Evidence from three other sources must be considered: the myelogenesis of the fasciculus, the course of localized degenerations involving both this tract and the stratum sagittale internum, and the results of long-standing blindness or of localized lesions of the external geniculate body.

The early myelinization of the inferior longitudinal fasciculus gave Flechsig [18] the first clue to its importance and its peculiar shape. His discoveries were corroborated by Hösel [19] and more recently in a beautiful monograph by Pfeifer,[20] although some of the latter's conclusions

Fig. 17 (case 2).—Section through middle portion of corpus geniculatum externum: the limits of the degenerated (mesial) portion are indicated by arrows (on the left); there is a large area of gliosis, with almost complete loss of cells along the mesial border; both the large and the small cells have suffered. Van Gieson. Photograph; × 80.

appear to be erroneous. A detailed description of the tract in the brain of a new-born baby, as seen in sections and in a wax reconstruction, will be given in a later paper of this series.

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18. Flechsig, P.: Weitere Mitteilungen ueber die Sinnes- und Associationscentren des menschlichen Gehirns, Neurol. Centralbl. **14**:1118-1124, 1895; **15**:2-4, 1896.

19. Hösel, H.: Ueber die Markreifung der sog. Köpergefühl-Sphäre und der Reich- und Sehstrahlung des Menschen, Arch. f. Psychiat. **39**:195-239, 1905.

20. Pfeifer, R.: Myelogenetisch-anatomische Untersuchungen über den zentralen Abschnitt der Sehleitung, Monogr. a. d. ges. Gebiete der Neurol. u. Psychiat. **43**, 1925.

Important points in the anatomy of the tract have thus been gained. But as Brouwer [6] has remarked, such studies do not alone suffice to prove that the fasciculus represents the optic radiation. Fortunately other evidence is at hand.

The fate of partial degenerations involving both the internal sagittal stratum and the inferior longitudinal fasciculus may be illustrated by the second case reported here. The distinction between the ventral normal and the dorsal degenerated half of the latter tract is sharply marked throughout its course. In the latter tract, it is lost both anterior and posterior to the lesion. A better example still is a case reported by Brouwer [6] (case 2, left hemisphere), which he has kindly permitted me to examine and use as the basis for a wax reconstruction to be described in a later paper. In this case, an intensive search revealed three small lesions in the inferior longitudinal fasciculus, which could be traced anteriorly and posteriorly as far as the tract could be followed, without changing greatly in size, shape or relative position. Two of them were so small that they produced only insignificant changes in the corpus geniculatum, and they were disregarded in the original report. The lesion causing one of them lay in the cortex,[21] and did not directly involve the fasciculus; no localized atrophy was produced in the stratum sagittale internum. The other two [22] involved both tracts about equally; but while the clean-cut lesions could easily be followed in both directions in the fasciculus longitudinalis, they became small and indefinite in the stratum internum and were lost before the corpus geniculatum was reached.[23] The latter tract, on the other hand, contained irregular, diffuse areas of degeneration not represented in the former and of which the origin was not clear. Brouwer's case 1 might be used to illustrate the same point.[24] Other cases of interest are given by Winkler,[25] Niessl von Mayendorf,[26] and by von Monakow.[27]

The results of a lesion of the corpus geniculatum externum have been reported by Henschen [28] and by von Monakow,[29] but the illustra-

21. Brouwer (footnote 6, fig. 16, lesion 3).

22. Brouwer (footnote 6, figs. 14 and 15, lesions 1 and 2).

23. Brouwer (footnote 6, fig. 13, p. 150; fig. 15, p. 151; fig. 14, plate III-IV).

24. Brouwer (footnote 6, especially figs. 6 and 7, p. 137, and figs. 4 and 7, plates I and III).

25. Winkler, C.: De Achterhoofdskwab en de Halfblineid, Psychiat. en Neurol. Bl., 1910, pp. 1-17; Over gelocaliseerde atrophie in het corpus geniculatum laterale, Versl. d. k. Akad. v. Wetensch., Wis- en Natuurk., Nov. 30, 1912, pp. 714-725.

26. Niessl von Mayendorf: Vom Fasciculus longitudinalis inferior, Arch. f. Psychiat. u. Neurol. **37**:537-563, 1903. Footnote 15.

27. Von Monakow (footnote 4, p. 749 et seq.).

28. Henschen (footnote 7, **1**, case 11, S. p. b. g.).

29. Von Monakow (footnote 4, p. 721).

tions they give do not seem to settle satisfactorily which tract is more completely degenerated. It appears that the degeneration involves chiefly the fasciculus longitudinalis in Henschen's cases—chiefly the stratum internum in von Monakow's; but neither is conclusively demonstrated. In the cases of Archambault [12] and von Stauffenberg [30] atrophy is almost confined to the fasciculus longitudinalis. Henschen [31] has also reported the result of long-standing peripheral blindness. His illustrations, taken from the unstained brain, seem to show the fasciculus longitudinalis inferior degenerated; but this is somewhat inconclusive. More complete reports of such cases are greatly needed.

THE EXTENT OF THE OPTIC RADIATION IN THE FASCICULUS LONGITUDINALIS INFERIOR

Henschen [1] has supposed that the optic projection fibers occupy only a small portion of the fasciculus longitudinalis—about 4-6 mm. of its central portion, as seen in cross-section. This seems inherently improbable in view of the evidence which has been already cited. The entire tract was free from degeneration in case 1 on the left, and in several other similar cases. A lesion in the striate cortex produced a small, localized, consistent degeneration almost at the inferior edge in the case of Brouwer from which the wax reconstruction, to be described later, was made; and there appears to be a corresponding atrophy in the corpus geniculatum. A case reported by Lenz [8] seems conclusive in regard to this point also. A definite lesion (an infiltrating tumor) cut off the upper 3 mm. of the fasciculus longitudinalis inferior and the anterior tip of the striate area; there was an upper quadrant defect reaching to within 30 degrees of the fixation point; no other degeneration was seen in the fasciculus longitudinalis. There is little to add to Lenz' criticism of Henschen's evidence, in the paper cited.

STRATUM SAGITTALE INTERNUM

It seems unnecessary to suppose that this tract also contains geniculostriate fibers, as von Monakow [4] still appears to do. The fact that the fibers of the fasciculus longitudinalis inferior closely resemble those of the optic nerve, while enormously exceeding them in number, makes it seem improbable that additional axons of a different histologic type are required to transmit the visual impulses. Von Monakow's opinion appears to be founded chiefly on some early experiments, in which degeneration of both strata sagittalia followed the extirpation of the occipital lobe of an ape.[5] But the operation was performed without

30. Von Stauffenberg, H.: Ueber Seelenblindheit, Arb. a. d. hirnanat. Inst. in Zürich **8**:1-121, 1914.

31. Henschen (footnote 7, **1**, case 1, Norström).

regard to the area striata; it may have failed to destroy all of it, and certainly damaged other neighboring cortical regions. A detailed criticism of the cases which he cites (especially pp. 701-760) is perhaps not necessary to justify the statement that none of them are conclusive, and some definitely favor the view that optic projection fibers run in the fasciculus longitudinalis inferior alone.

As to the function of the stratum sagittale internum, we have no new data. Flechsig [18] believed that it contained corticifugal fibers; the experiments of Bouman [32] seem to show that such fibers exist, but do not definitely locate them.

THE SHAPE AND SITUATION OF THE CORPUS GENICULATUM EXTERNUM

Before proceeding to a consideration of the relations of the external geniculate body, it may be wise to consider briefly its configuration and its position in the brain, especially from a comparative anatomic point of view. It was long since pointed out (apparently first by von Monakow) that the development of the thalamus as a whole has caused profound alterations in the corpus geniculatum in the transition from animals to man. In a recent attempt at analysis [16] of the forces at work here, it was shown that what is recognized as the lateral geniculate body in man is a development of the dorsal nucleus of the "primitive mammalian type" of geniculate body, seen for example in the rabbit. The homology of the primitive ventral nucleus is uncertain; it is probably represented by the griseum praegeniculatum (Minkowski [33]). The hilus, a groove marked by the entrance of blood vessels in apes and man, is the remains of the exposed superolateral surface of the primitive nucleus. But in the primates, the hilus faces directly downward or a little mesially (fig. 2). The groove does not run exactly anteroposteriorly; its anterior end (and that of the whole nucleus) is usually slightly mesial to its posterior end.[34] It is lined by two layers of large cells. The roughly hemispherical body is most variable in shape in human beings. It lies mainly dorsal, but sometimes distinctly lateral to the hilus. The temporal horn or "tail" is usually well marked; it extends laterally, usually slightly downward, and often a little backward from the body. It corresponds apparently with the superior edge of the primitive mammalian nucleus.

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32. Bouman, K.: Experimenteele onderzoekingen over het cerebrale optische stelsel, Dissert., Amsterdam, 1905.

33. Minkowski, M.: Ueber den Verlauf, die Endigung, und die zentralen Repraesentation von gekreuzten und ungekreuzten Sehnervenfasern bei einigen Säugetieren und beim Menschen., Schweiz. Arch. f. Neurol. u. Psychiat. **6**:2-1-252 and 268-303, 1920.

34. Marburg, O.: Mikroskopisch-topographischer Atlas des menschlichen Zentralnervensystems, ed. 2, Vienna, 1910, tab. 30, fig. 75.

In sections from the extreme posterior end of the structure (fig. 7) it may appear chiefly below the body, and it is apparently this portion which is referred to by Henschen [1] as the "inferior" portion of the nucleus. Perhaps it is clearer to call it the lateral portion, as will be done in this paper. There is also a definite mesial projection or horn, sometimes as large as the temporal horn, the significance of which has usually escaped attention. In some apes, the two are approximately equal in size. Often this mesial projection is not seen in sections from the posterior end, but it usually extends forward of the body, sometimes running out into a fine point.

These details of shape and position, unimportant in themselves, have led to much confusion in the literature. In this paper, the convention will be adopted that the exposed (pial) hilus surface will be considered ventral, the body dorsal, the temporal horn lateral, and the mesial horn directly mesial. This is the most nearly correct nomenclature for the majority of nuclei.

THE SHAPE OF THE AREA STRIATA

This will be considered more fully in the fourth paper of this series. Here it may merely be recalled that there is a considerable normal variation. The striate area often extends outward to the lateral surface of the brain, suggesting the condition in apes. The anterior border is sometimes indefinite, and the architecture is somewhat simplified anteriorly (Lenz,[8] Cobb [35]). The striate area is divided into two parts by the calcarine fissure. The lower of these parts extends 1 or 2 cm. farther forward than the upper, and is considerably larger than it. It seems better to speak of the anterior, posterior, superior and inferior portions of the striate area as a whole, without special reference to the calcarine fissure, as this appears to agree in general with both its neurologic and its vascular connections.

The anatomy of the fasciculus longitudinalis inferior will be considered in detail elsewhere.

THE PROJECTION OF THE CORPUS GENICULATUM ON THE STRIATE CORTEX

A study of the right hemisphere in case 1 shows that a lesion destroying all of the area striata except its posterior extremity is followed by an atrophy of all of the corpus geniculatum, except its posterior end. Are we justified in assuming that this relation is constant—that the anterior portion of the cortical visual sphere is in relation with the anterior portion of the external geniculate body, the posterior with its posterior portion?

35. Cobb, S.: On the Application of Micrometry to the Study of the Area Striata, J. f. Psychol. u. Neurol. **31**:261-274, 1925.

Few observations bearing on this point are available in the literature. Minute studies of the cortex, and fairly complete accounts of the condition of the strata sagittalia are numerous, but often the corpus geniculatum is dismissed with a description of two or three sections. The only case reports which are really complete in this respect are those of Brouwer.[6] In an article illustrated with many diagrams and photographs of different levels of the occipital lobes and corpora geniculata, he describes fully two cases in which there were lesions of the striate cortex and strata sagittalia. The second case is of particular interest in the present connection. In the right hemisphere, a large lesion had destroyed all of the area striata except a small portion of the upper lip of the calcarine fissure at the level of the tip of the posterior horn of the ventricle. All of the external geniculate body was atrophic, except a small area anteriorly and mesially. This agrees well enough with the tentative conclusions we have drawn from the first of the cases here reported. In the other case described by Brouwer, the poles of both occipital lobes contained large lesions, which had produced a corresponding atrophy chiefly in the posterior portion of both lateral geniculate bodies. This is most clearly seen in the right hemisphere. But the relationship between cortex and nucleus is not as definite as in his case 2, especially as the central portion of the fasciculus longitudinalis is involved on both sides.

There appear to be no other cases in the literature in which the anteroposterior relationships between striate cortex and corpus geniculatum have been directly determined. Indirect evidence, favoring the hypothesis already made, will be found below in the section devoted to the position of the representation of macular vision.

In regard to the respective connections of the upper and lower portions of the striate cortex—the vertical organization of the visual system, as it has been called—our knowledge is somewhat better. It appears that the blood supply of the occipital lobe is divided in such a way that the lower half of the striate area may be destroyed quite accurately by a vascular lesion without the upper half being disturbed. The corresponding edge of the fasciculus longitudinalis may or may not be affected at the same time. Or it may be the seat of an independent lesion, often limited to the upper or lower half. The result of a localized lesion in the cortex [36] on the fasciculus longitudinalis is seen in Brouwer's case 2, on the left side, which has served as a basis for the wax reconstruction which will be described in a later paper. A more precise description of it will be given in connection with the wax model. For the present, it is enough to observe that it lies on the lower edge of the area striata, about its middle. The degeneration in the fasciculus longi-

36. Brouwer (footnote 6, p. 149, fig. 11).

tudinalis can be distinctly traced from it, although it appears absurdly small. It lies in the tip of the inferior (horizontal) limb of the radiation.

There appear to be no precisely similar cases in the literature. In Meyer's case 2 [13] the degenerations in the fasciculus longitudinalis were not followed into the cortex or geniculate body. Lenz [37] has published two cases on different occasions in which localized lesions of the upper part of the striate area, partly continuous into the upper edge of the fasciculus longitudinalis, had produced no other degenerations elsewhere in it.

Cases of complete destruction of the entire upper half of the striate area alone are rare. None has been adequately described. Cases in which the lower calcarine lip is destroyed, with direct involvement or secondary atrophy of the lower limb of the fasciculus longitudinalis inferior, are more common, and several are available with microscopic description. They have been ably summarized by Lenz.[37] Typical cases are given by von Monakow [38] and Lenz.[37] It is important to notice that no cases have been reported in which a degeneration of the lower part of the calcarine cortex has caused an atrophy of the upper part of the fasciculus longitudinalis, or conversely, which taken alone seems sufficient to disprove Pfeifer's hypothesis that fibers from both lips of the calcarine cortex cross each other in the subcortical white matter to reach the opposite edge of the fasciculus longitudinalis. Other evidence that the upper part of the radiation supplies the upper part of the striate cortex, and the lower part the lower has been considered elsewhere,[16] and further evidence will be produced in connection with the wax reconstructions.

THE FASCICULUS LONGITUDINALIS INFERIOR AND THE CORPUS GENICULATUM

In the second case here described, there appears to be a relationship between the upper half of the radiation and the mesial half of the nucleus. Similar cases are numerous. In each of two of Henschen's cases,[39] an old lesion had destroyed the upper part of Wernicke's field. Henschen states that the corpus geniculatum itself was primarily involved, but the illustrations do not bear this out. A degeneration of the dorsal half of the fasciculus longitudinalis inferior and an atrophy of the mesial third or half of the ganglion are seen. Three cases almost identical with ours, showing a large lesion in the vicinity of the pulvinar with destruction of the upper half of the fasciculus longitudinalis and

37. Lenz, G.: Die hirnlokalisatorische Bedeutung der Makulaaussparung im hemianopischen Gesichtsfelde, Klin. Monatsbl. f. Augenh. **53**:30-63, 1914. Footnote 8.

38. Von Monakow (footnote 4, fig. 246).

39. Henschen (footnote 7: Esche, **3,** case 13, per Jonsson, 4).

secondary atrophy of the mesial limb of the corpus geniculatum, are reported by Winkler.[25] Similar cases are reported by Archambault,[12] Niessl von Mayendorf,[15] von Stauffenberg,[30] and others.

The converse situation—a lesion in the lower half of the fasciculus longitudinalis inferior with atrophy of the temporal horn of the geniculate body—is satisfactorily reported and illustrated by Winkler,[25] Niessl von Mayendorf [15] and Pfeifer.[29] Von Monakow [4] accepts these relations in general. Reference to earlier cases may be found in Lenz' monograph.

No satisfactory cases of small lesions involving a portion of the corpus geniculatum alone have been published. Lesions of the radiation cause, at most, indefinite retrograde changes in the cortex, which are not of localizing value.

THE POSITION OF THE RESPECTIVE RETINAL QUADRANTS IN CORPUS GENICULATUM, RADIATION AND CORTEX

We are now able to articulate the central visual system anatomically. What are its connections with the peripheral visual system?

Until within a year, the information gained up to this point could not have been put to practical use, as the projection of the retina on the corpus geniculatum externum had never been demonstrated anatomically. Thanks to the work of Brouwer and Zeeman,[10] the position of the upper and lower retinal quadrants has been satisfactorily demonstrated in the ape, whose visual system possesses a close homology with that of man. In their hands tiny lesions of the retina, made under the ophthalmoscope, produced localized degenerations in the optic nerve and tract, which could be accurately followed in Marchi stained serial sections. The areas of degeneration were always consistent through a large series of experiments. Lesions of the upper quadrant produced a small area of degeneration in the mesial horn of the nucleus; those of the lower quadrant, in the temporal horn; while the smallest lesion of the macula produced a massive degeneration of the body. The evidence afforded by their beautiful preparations is indisputable.

If we transfer these results to the human being, we have reason to believe that the dorsal retinal quadrants lie dorsal in the optic radiation and cortex, the ventral quadrants ventral. This is at once seen to be the relationship suggested by Hun,[40] and is well supported by Henschen,[1] Lenz [3] and Holmes.[41] Their theories were built on the results of perimetry, however, which is uncertain ground. Contradictory cases were continually being found, in which vision appeared to be intact in a

40. Hun, H.: A Clinical Study of Cerebral Localization, Illustrated by Seven Cases, Am. J. M. Sc. **43**:140-169, 1887.

41. Holmes, G.: The Cortical Localization of Vision (Montgomery Lecture), Brit. M. J. **2**:193-199 (Aug. 16) 1919.

segment which should have been blind, or scotomas were found without degenerations. This gave ample reason for the objections of von Monakow, Winkler, Pfeifer, and others; such, however, can scarcely be raised against purely anatomic facts.

Perhaps it may be of interest to review briefly the more important points to which the clinicopathologic method has led. All of the earlier work on the subject was criticized in the excellent monograph of Lenz [3] in 1909. There were many ambiguous cases (including some of those on which Henschen had founded his hypothesis) but he was enabled to make the important statement that "It is striking that we have no single case up to the present in which a superior lesion [of the occipital lobe] has produced an upper quadrant [visual field] hemianopsia, or vice-versa." Henschen's recent review [1] adds little to what had already been collected. Holmes' paper [41] gives the results of a large number of war injuries, but without any microscopic descriptions. Individually, such cases can have little significance; but collectively they form valuable additional evidence. On this basis, we may consider the statistics, collected from German, French and English sources by Best [42] on the visual symptoms resulting from cerebral war wounds. He found that in 58.1 per cent of all fresh cases showing scotomas, the chief defect was in the lower field; in only 5.8 per cent was it in the upper field. The obvious interpretation is that the more basal wounds were usually fatal at once. It is unnecessary to go into this aspect of the subject in greater detail, as it has been fully discussed by the authors already cited.

THE POSITION OF THE REPRESENTATION OF THE MACULA IN THE CORTEX

In the experiments of Brouwer and Zeeman on apes, the macular representation was found to occupy a large part of the corpus geniculatum, between the upper and lower quadrants. After a macular lesion, the degeneration extended ventrad as far as the two rows of large cells along the hilus. The degeneration extended to the posterior end of the nucleus. Stained granules were found at the anterior end also, but they may have represented fibers passing through it, not terminating there. Our knowledge of the position of macular representation is supplemented by the investigations of Rönne,[43] who studied human cases of toxic central scotoma by means of myelin sheath and cellular stains of serial sections through tract and corpus geniculatum. In the latter body he found the cellular degeneration began, and degeneration of fibers ceased just in front of the middle of the nucleus. Anteriorly, the

42. Best, F.: Hemianopsie und Seelenblindheit bei Hirnverletzerungen, Arch. f. Ophth. **93**:49, 1917.

43. Rönne, H.: Die anatomische Projektion der Makula im Corpus geniculatum externum, Ztschr. f. d. ges. Neurol. u. Psychiat. **22**:469-484, 1914.

atrophy was confined to a small group of cells in the dorsal layers of the body, toward the lateral side. It grew progressively larger posteriorly, until it included the entire body, with the exception of the two layers of large cells along the hilus. The results were consistent in all of the three cases examined.

Accepting this localization in the corpus geniculatum, the scheme of relationships which has already been outlined forces us to look for the representation of the macula at the occipital pole. Its representation must be large. In Brouwer's case 1, the degenerations in both corpora geniculata correspond fairly well with Rönne's description of the corpora geniculata in his cases. If anything, the atrophy is slightly more extensive in the right hemisphere of Brouwer's case; while in the left hemisphere, some of Rönne's macular territory appears to have escaped destruction. Practically all of the white matter of the occipital lobe was destroyed as far forward as the level at which the ventricle first appears. The first case reported herein showed a surviving area which exceeded the limits set by Rönne laterally, but did not extend nearly as far forward as did his lesions. Certainly less than half of the macular area in the corpus geniculatum was preserved. The preserved area extended 11 mm. anteriorly from the occipital pole.

No other satisfactory cases with detailed microscopic examination are available for study from this point of view. For confirmation of it, we must turn to cases where macular scotomas (or persistence of the macular field alone) have been demonstrated by perimetry. This is the more necessary because Rönne's method of investigation (the atrophy of cells in the second neuron after a toxic lesion of the first) is not perfectly definite, and the method used by Brouwer and Zeeman gives no evidence of either the presence or the absence of macular cells in the anterior part of the corpus geniculatum. Unfortunately, serviceable clinicopathologic observations are also rare. Lenz, in 1909, found no one that was conclusive, but a majority of them seemed to favor the location of the macula at the occipital pole. He draws no conclusion as to the size of the macular cortex, but the case which he himself reports seems to give some idea of its size. The patient had an absolute lower quadrant defect, reaching from the periphery to within 30 degrees of the fixation point. The relative defect for colors approached the center more closely. An infiltrating sarcoma had destroyed the striate cortex along the anterior portion of the upper lip of the calcarine fissure, from 21 mm. to 36 mm. anterior to the occipital pole. About 2 mm. of the dorsal edge of the fasciculus longitudinalis was invaded and another millimeter degenerated; that is, the primarily destroyed region lay within the secondary degeneration. If the perimetry is reliable, this seems to show that the central field up to 30 degrees is located within 2 cm. of the occipital pole.

The conclusions which Holmes reached after a survey of war injuries are similar to those of Lenz. But he gives few necropsy reports and no microscopic examinations. The most pertinent case is that of a lieutenant who showed, two days before death, a concentric central scotoma, extending to 30 degrees on all sides of the fixation point. At necropsy, an infected gunshot wound was found destroying about 3 cm. of the tip of both occipital lobes. It is not possible to say how much farther the destruction extended, nor can we be sure of the accuracy of perimetry when the fixation point is destroyed. But this case gives us at least another approximation of the size of the macular area.

Corroboration of this localization of the macula may be found in another direction also. It was shown qualitatively by Lenz,[8] and demonstrated with the greatest accuracy by Cobb,[35] that the structure of the cortex at the anterior end of the striate area is simpler than that at the posterior end. Lenz' sections (from a single case) seem to show a decrease in the thickness of layer IV. The differences found by Cobb are smaller, and were only distinguished by painstaking micrometry, but they appear to be constant. Obviously, one would expect the area of macular representation to have a more complex structure than the area on which the periphery of the visual field is projected.

At all events, the evidences elicited by Rönne, Lenz and Cobb, and that afforded by the most acceptable clinicopathologic cases support each other, and give good reason to believe that the macula is represented in the posterior portion of the area striata.

CALLOSAL VISUAL FIBERS

From theoretical considerations, Heine[44] was led to believe that fibers must extend from one retinal half to both hemispheres, to subserve stereoscopic vision. There are various objections to this theory. First, it is a matter of everyday experience that binocular and stereoscopic vision occurs independently in both retinal halves. This becomes striking in the attempt to make stereoscopic drawings, and Heine's experiments are open to the same interpretation. Secondly, it is found clinically that there is no disturbance of stereoscopic or binocular vision in patients with ordinary hemianopia due to lesions either of the tract or of the radiation. Thirdly, no cases have been reported in which a lesion of the corpus callosum or any other region has produced a loss of binocular vision except through strabismus. Fourthly, disturbances of stereoscopic, though not of binocular, vision have been shown to be due to a bilateral lesion of the upper occipito-

44. Heine, L.: Sehschärfe und Tiefenwahrnehmung, Arch. f. Ophth. **51**:146-185, 1900.

parietal region. The symptoms in these cases are so striking as to be unmistakable.

A similar suggestion was made by Wilbrand [2] and by Lenz[3] to account for the preservation of macular vision in many cases of hemianopia. Wilbrand supposed that the bifurcation of fibers occurred in the chiasm; but since the recognition of the fact that hemianopia due to total lesions of the tract does not show the typical sparing of the macula, his theory has been abandoned. Lenz' theory, that the bifurcation occurs in the neighborhood of the temporo-occipital juncture, is contradicted by the fact that occasional cases of complete hemianopia occur from lesions of the occipital cortex alone, and by the cases of bilateral hemianopia with retained macular vision (Rönne [9]). These he explains as anomalies of development. As positive evidence he cites five cases in which macular vision was retained after apparently complete destruction of the striate cortex. All these cases are old, and without microscopic reports; four of them were tumor cases which are obviously unsuitable for deciding such a point. The other cases which he cites are all certainly open to other interpretations. Van Valkenburg [45] has produced impressive pathologic evidence that no callosal fibers connect the two halves of the visual system. In a lesion of the corpus callosum no degeneration was found in the fasciculus longitudinalis, geniculate body or striate cortex; and conversely in extensive lesions of the visual system no degeneration was found in the corpus callosum. He also cites the careful studies of Beevor [46] in apes, which failed to show any such commissural fibers.

My experience agrees with his. No degenerated fibers were found leading to the left striate cortex of case 1, and no preserved fibers can be traced from it to the corpus callosum. No degenerated fibers lead to the corpus callosum in case 2. In studying the brains of animals, where the callosum has a distinctive histology, none of its fibers could be seen entering the fasciculus longitudinalis or striate cortex. In a wax reconstruction of the visual system of a new-born child, in which all myelinated fibers of the occipital lobe were included, none was found running to the corpus callosum.

This point would scarcely demand so much attention if it were not for the continued assumption of the existence of such fibers in Wilbrand and Saenger's *Handbuch* (vol. 7), and more recently in an article by Pfeifer,[20] who is apparently not familiar with van Valkenburg's work. He cites as evidence a case published by Lenz,[37] in 1914, in which the

45. Van Valkenburg, C.: Experimental and Pathologico-Anatomical Researches on the Corpus Callosum, Brain **36**:119, 1913.

46. Beevor: On the Course of the Fibers of the Cingulum and the Posterior Parts of the Corpus Callosum and Fornix in the Marmoset Monkey, Phil. Tr. Lond., series B **182**:135, 1892.

point of separation of the commissural fibers was supposedly located by a tumor of the temporo-occipital region, which caused hemianopia, at first with macular sparing, but later complete. But Cushing [47] has shown that tumors of the tip of the temporal lobe—even anterior to the corpus geniculatum—may also cause first an incomplete then a complete hemianopia, which may regress again after surgical intervention. Lenz' observation is, therefore, open to another interpretation, and, as will be shown in another paper, fits well with certain other facts bearing on the situation of the macular fibers in the radiation. In addition, Pfeifer believes that he has found commissural fibers in myelinogenetic preparations. His illustration is by no means conclusive, however, and as we shall see, a more intensive study of similar material at this laboratory failed to show any such fibers.

SUMMARY

Perhaps the arrangement of the central visual system which my review appears to reveal can be made most clear by a comparison with other well known theories. We must first pay tribute to Henschen, whose labors laid the foundation for all modern theories of projection. His theory that the upper lip of the calcarine fissure and upper half of the optic radiation represent the upper half of the retina finds confirmation in purely anatomic studies such as the present. But it appears that the macula has a large representation in the posterior portion of the area striata, and not above it, as his latest paper [1] suggests; and the optic radiation appears to occupy the entire fasciculus longitudinalis, not merely a few millimeters in the center of it. It is perhaps only a question of terminology whether the representation of the upper retinal quadrant shall be considered superior, as by Henschen, or mesial, as by most other observers; but this point may lead to confusion.

The observations here presented are closely in accord with the theories of Wilbrand and of Lenz, which may be regarded as an extension of Henschen's theory. We are particularly indebted to Lenz for evidence of the seat of the macular representation at the occipital pole. This localization is accepted by Wilbrand also. But these investigators did not attempt to determine the approximate size of the macula, they did not commit themselves as to the location of the optic radiation, or the retinal projection in the corpus geniculatum, and both laid stress on the supposed existence of a bilateral cortical representation of the macula. Meyer,[13] von Stauffenberg [30] and Pfeifer [20] have each given valuable information regarding the course of the fasciculus longitudinalis and its relation to the corpus geniculatum; but the scheme of organization which they all favor (the lower half of the fasciculus longitudinalis

47. Cushing, H.: Distortions of the Visual Fields in Cases of Brain Tumor, Brain **44**:341-376 (Jan.) 1922.

being supposed to end in the anterior part of the calcarine fissure) is certainly erroneous, as Henschen had already shown. The studies of Niessl von Mayendorf [15] leave little doubt as to the identity of the fasciculus longitudinalis inferior, or as to its connections with the corpus geniculatum, but are not concerned with the projection of the retina. Holmes' paper [41] on the cortical representation of the retina is a masterpiece of clinical observation, and he gives what appears to be the most accurate diagram of localization in the striate cortex yet published. But in few of the cases which he reports was necropsy performed, and apparently none had microscopic examinations. This is a serious limitation, and it prevented him from passing a further judgment on localization in the radiation and corpus geniculatum.

CONCLUSIONS

1. It appears to be possible now to construct a scheme of the projection of the retina in the central visual system on a purely anatomic basis, without reliance on perimetry.

2. The fasciculus longitudinalis inferior (external sagittal stratum) of the occipital lobe contains all of the geniculostriate projection fibers, and no others.

3. The projection of the retinal quadrants and macula in the central portion of the visual system is constant. The upper retinal quadrant is projected on the mesial limb of the corpus geniculatum, the upper portion of the fasciculus longitudinalis inferior and the upper anterior portion of the striate cortex. The lower quadrant lies laterally in the corpus geniculatum, inferiorly in the radiation and cortex. The macula is represented between them in the upper portion of the posterior half of the corpus geniculatum, and posteriorly in the striate cortex, where its representation is extensive.

4. There appears to be no theoretical necessity for callosal visual fibers and no satisfactory anatomic evidence of their existence.

In the preparation of this paper, as with the first two in the series, I have enjoyed the help and criticism of both Dr. Ariëns Kappers, director of the Central Institute for Brain Research, and Professor Brouwer of the University of Amsterdam. It is a pleasure to acknowledge my indebtedness to both of them.

A CASE OF NONSYPHILITIC PUPILLARY INACTION

ASSOCIATED WITH EVIDENCE OF VEGETATIVE IMBALANCE *

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As we have not before encountered or found in the literature any case of acquired immobility of pupils without either syphilis or local eye pathologic condition as a basis, a record of this case is considered desirable. In commenting on it we venture also to bring forward certain reasons that suggest to us the possibility that the condition may have arisen on a basis of vegetative imbalance.

REPORT OF CASE

Early History.—The patient, a man, aged 30, a nurse, first experienced difficulty with vision six years before while living in Norway. His right eye ached; the pupil was dilated and would not contract even in bright sunlight. Objects appeared smaller when viewed with the right eye alone. His case was studied in clinics in various cities by ophthalmologists, who declared they had never seen such a pupil except in association with syphilis and yet were unable to make a diagnosis of syphilis in this case.

When first seen in this clinic in September, 1921, the patient was using pilocarpine to contract the pupil in bright sunlight. Ophthalmologic examination revealed: uncorrected vision, right 20/15 — 1, left 20/15 +; corrected vision, right 20/15, left 20/15. Correction on the right was + 0.62 sphere and + 0.25 cylinder, axis 90 degrees; correction on the left was + 0.62 sphere and + 0.25 cylinder, axis 180 degrees. There was 4.5 degrees esophoria with 1 degree right hyperphoria and convergence excess of 2 degrees. Amplitude of accommodation was: right, 3; left, 5. Gross color and form fields were negative and the blind spots were normal. Both pupils were regular; the right was immobile to light, both direct and consensual, but had a slight reaction in convergence (as seen through the magnifying glass). Homatropine and cocaine dilated the right pupil still farther, and eserine contracted both pupils. The fundi were normal.

The chest was examined with the object of determining whether pressure on the sympathetic trunk was the cause of the anisocoria. No evidence of this was obtained. The patient failed to appear for a neurologic examination as requested.

The patient again appeared in January, 1923, to say that the left eye was "going bad"; the pupil was dilating and scarcely reacting to bright light.

Detailed Study.—In January, 1926, the patient returned, this time because he was hardly able to read because of blurring of vision. A complete history and examination were obtained and may be summarized as follows:

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The family history was unimportant except that one sister was partially deaf. In the past the patient had had only mumps, tonsillitis and acute catarrhal jaundice. In addition to his eye trouble he had noticed weakness in the knees, trembling, and a sense of oppression in the head within half an hour after eating sweets, which he therefore avoided. The patient had worked daily, was athletic, could raise 100 pounds (45 Kg.) above his head with either hand, and used no tea, coffee, tobacco or alcohol. His bowels moved regularly, twice daily. He was emotional and rather easily suggestible.

Fig. 1.—Patient looking at object 30 feet distant. Photographic measurements of pupils: right 4 — mm., left 5 + mm.; all photographs were taken with an arc lamp on each side of camera 3 feet from patient's face.

Fig. 2.—Patient converging on object 14 inches distant. Photographic measurements of pupil: right 4 mm., left 5 + mm.

Examination.—He had an early alopecia of the coronal type; the blood pressure was 128 systolic, 64 diastolic; the pulse was 84, of good quality; the radial arteries were distinctly palpable but not sclerosed; the brachial arteries were palpable.

Ophthalmologic examination revealed that objects appeared smaller when viewed with the left eye alone. To see objects close, as for reading, the man closed the left eye and held objects within 8 inches (20 cm.). The left pupil was 5 mm., the right 4 mm. The right was immobile to light, both direct and consensual, and also in convergence; the left reacted slightly to both forms

of stimulus. Von Graefe's lid reaction was absent on both sides. The right inferior, right superior and both external recti muscles were weak. There were vacuoles in the right lens and many fine lens opacities as well as floating opacities in the right vitreous. The fundi showed heaping of pigment about small white spots far in the periphery of each retina. The amplitude of accommodation was: right from 8½ to 10 and slow; left, 6¼.

The patient stated that pilocarpine dropped into the left eye contracted both pupils (left more than right) and this was verified. But if it was dropped into

Fig. 3.—After drinking 12 ounces (350 cc.) of cold carbonated water. Patient looking at object 30 feet distant. Photographic measurements of pupils: right 3 + mm., left 5 — mm.

Fig. 4.—After slight irritation of nasal mucous membrane with pepper. Patient looking at object 30 feet distant. Photographic measurements of pupils: right 3 mm., left 5 — mm.

the right eye, this pupil alone contracted. Reaction to pilocarpine was more energetic than reaction to eserine, especially in the left eye. Cocaine dilated both pupils. Further, the right pupil contracted to 3 mm. whenever the patient swallowed anything, especially cold carbonated water. It contracted still farther on stimulation of the nasal mucous membrane with pepper, or when the patient coughed or sneezed. Neither pupil dilated when painful stimuli were applied to the skin of the neck. The left pupil did not contract under the same stimuli as the right (figures 1-5). Möbius' sign was negative. Epinephrine dropped into the eyes caused vasoconstriction lasting one and one-half hours.

General chest and abdominal examination revealed nothing abnormal.

Neurologic and endocrinologic examination showed the following: fatigability, dry hair, absence of pharyngeal reflex, dryness of nose and eyes, infrequent winking, heart rate a little rapid, feminine escutcheon, excessive sweating.

The urine was clear and amber colored; the total twenty-four hour excretion was 1,700 cc., specific gravity 1.017, total solids 67.35 Gm., reaction p_H 6, ammonia 0.601 indican 5+; several pus cells were seen in each high power field. Investigation of the pyuria revealed no prostatitis but a congested bladder mucosa and injection of the vessels at the bladder neck. One ounce (30 cc.) of residual urine was obtained. The left ureteral orifice gaped, suggesting an incompetent sphincter. The patient was advised to have a segregation study made but this was not done.

Blood examination revealed the following: Wassermann test negative, nonprotein nitrogen 25.5, uric acid 3.5, sugar 95, erythrocytes 5,000,000, leukocytes 7,200, hemoglobin 90 per cent. The alveolar carbon dioxide tension was 39; a trace of acetone was present in the expired air. The spinal fluid was under

Fig. 5.—Same conditions as in figure 4 after still further irritation of nasal mucous membrane. Photographic measurements of pupils: right 2+ mm., left, 5 mm.

normal pressure; 5 cells per cubic millimeter were present; globulin, colloidal gold and Wassermann tests were negative.

Gastric analysis results are given in table 1.

TABLE 1.—*Gastric Analysis* *

	Residue	½ Hour	1 Hour	1½ Hours	2 Hours	2½ Hours
Total acid	32	24	44	28	40	54
Free hydrochloric acid	16	10	8	14	28	42

* The irregular form of this curve suggests pylorospasm.

Roentgenograms of the teeth revealed no abnormality. The tonsils were definitely infected and have since been removed without altering the condition of the pupils. A fluoroscopic examination of the chest revealed nothing abnormal, but a stereoscopic roentgenogram showed slight thickening of the lung roots, the left containing a definite patch of calcification. This we believe to be an old bronchial gland of no present consequence.

To explain the feeling of weakness and tremor after eating sweets, two glucose tolerance tests were done with results as seen in tables 2 and 3.

TABLE 2.—*Results in Glucose Tolerance Test 1*

Sugar	Start	½ Hour	1 Hour	2 Hours	3 Hours	4 Hours
Cells	105	90	86	85	80	70
Plasma	81	78	71	77	80	81
Whole blood	91	83	77	80	80	77
Urine	29	36	31	24	20	7

TABLE 3.—*Results in Glucose Tolerance Test 2*

Sugar	Start	½ Hour	1 Hour	2 Hours	3 Hours	4 Hours
Cells	85	113	94	75	55	102
Plasma	88	127	119	91	57	85
Whole blood	87	122	108	85	56	92
Urine	28	8	6	16	16	13

In test 1 the drop in cell sugar was 35 points, that in plasma sugar only 10 points. The cell sugar drop was thus three and one-half times that of the plasma sugar, this being a typical insulin reaction. At the first hour the patient felt weak and sweaty. Furthermore, the curve is peculiar in going down immediately. This explains the weakness soon after eating sweets. In test 2 a more usual type of curve was obtained but the three curves dropped very low to 55, 57 and 56, respectively. Basal metabolism was + 5 and + 6, in two tests. The patient has been observed to have a pronounced Cheyne-Stokes respiration during sleep.

COMMENT

Question of Syphilis.—The first requisite in such a case is to rule in or rule out syphilis. With such pupils as those described the burden of proof must rest on him who denies the presence of syphilis. The arguments presented are these: 1. All serologic tests, including the Wassermann reaction with blood and spinal fluid, the cell count, globulin tests and colloidal gold curve on the latter were negative. 2. No signs of syphilis other than the pupils have been found. 3. The pupil which has passed through the stage of inaction to light, with preservation of reaction in convergence, and has become inactive to both, now responds readily during swallowing, coughing, sneezing or irritation of the fifth nerve. We have been unable to find any record of a similar reaction, but have tested one case of an Argyll Robertson pupil and failed to obtain contraction by irritation of the nasal mucous membrane, coughing or sneezing. 4. While a negative history of venereal infection as a rule is worthless, in this case we find a patient willing to submit to spinal puncture to defend his denial.

Other Causes of Argyll Robertson Pupils.—Since the right pupil passed through the Argyll Robertson stage, other causes of this condition should be considered. We have seen one case of definite Argyll Robertson pupils in a man suffering from a postencephalitic parkinsonian syn-

drome, and in whom examination for syphilis was entirely negative. Argyll Robertson pupils resulting from trauma have been reported.[1] Moore [2] has reported a series of seven cases which he considered congenital, nonsyphilitic Argyll Robertson pupils. None of these conditions obtains in this case.

While the foregoing considerations are all on the negative side of determining the pathologic condition, there are positive observations of value:

Irritation of the Fifth Nerve.—Fuchs [3] states that, normally, stimulation of any part of the body has only one effect on the pupil—*mydriasis* (local trauma to the eyeball is an exception). In his further discussion he makes it evident that the sympathetic reflex is the mechanism involved. In the case here reported, stimulation of the nasal mucous membrane produces *miosis,* while the normal skin reflex, dilatation through the sympathetic, is suppressed.

To determine if possible a lesion in the central nervous system to account for this miosis, the pathways of impulses originating in the nasal mucous membrane must be considered. Many and various reflex results may be obtained from stimulation of the nasal mucous membrane. Vagus reactions are encountered, such as slow pulse, dyspnea, asthma, nausea, vomiting, syncope or even death. Reflexes through other paths such as the genital reflex, coughing, sneezing, etc., are commoner. Some of those are evidently mediated through the fifth nerve to the pons and medulla and thence through the vagus. Others, especially the genital, are thought to be through the sympathetic.

We may here report briefly another reflex recently encountered.

A man, aged 71, suffering from cardiovascular-renal disease and maxillary sinusitis, was operated on at this clinic for drainage of the sinus. The trocar was inserted after local anesthesia in the usual way, and air was gently forced into the sinus with abundant discharge of pus through the natural sinus opening. When this had drained, a little more air was injected but the patient immediately complained of "feeling funny." His head was lowered, all apparatus was removed and he was asked whether he wished to be carried to a chair or preferred to walk. He chose to walk but found himself unable to move his lower extremities. The arms were weak. The man had a thick, bulbar speech and some dysphagia. Examination revealed a diplegia with a bilateral Babinski reflex, which disappeared in four days. In two weeks the patient was as well as ever.

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1. Guillain, G., and Laederich, L.: Signe d'Argyll-Robertson unilateral consécutif à un traumatisme cranien, Bull. et mém. Soc. méd. d. hôp. de Paris **46**:814 (May 19) 1922.

2. Moore, R. F.: Tr. Ophth. Soc. U. Kingdom **44**:38, 1924.

3. Fuchs: Textbook of Ophthalmology (tr. by Alexander Duane), ed. 8, p. 354.

This undoubtedly was due to a vascular spasm with partial occlusion and possibly thrombosis, all caused by reflex sympathetic stimulation of the vasoconstrictors in the medulla. Howell,[4] in discussing the nasal reflexes, traces motor impulses by reflex stimulation to the fifth, ninth, tenth, eleventh and twelfth cranial nerves. In addition, Bechterew describes a nasal reflex giving rise to ipsilateral contraction of the facial muscles. But no account has been found of action through the third or fourth cranial nerves. In the case described, the third nerve is affected—only the fibers to the intrinsic muscles of the eye, however. In all the reflexes described, the path to the medulla or pons is by way of the fifth nerve and through collaterals or the posterior longitudinal bundle to the other cranial nerves. Howell also traces the path for the sneezing reflex through the fifth nerve to the respiratory center from which impulses go to the nerves innervating the muscles of respiration.

The explanation may be suggested that just as reflexes to other parts of the body seem to occur in individual cases, so here a peculiarity occurs in this person. We are then confronted with the acquired nature and unilaterality of this condition. What sort of a unilateral change could have occurred in the pons to short-circuit a reflex to one part of the third nerve? And if we reject the explanation of a central nervous system lesion and accept the idea of a sympathetic reflex, we are confronted with miosis where we should expect mydriasis.

Reflex from the Chest.—The effect on the pupil may be secondary to reflex changes in the chest which have resulted from fifth nerve stimulation. It is known that the epiglottis may close, respiration cease and even the bronchial musculature contract in response to irritating gases in the nose; it is clear that far-reaching effects may operate and cause pupillary reaction by mechanisms in the mediastinum. Since coughing, sneezing, swallowing and irritation of the fifth nerve all give the same final result, it would be well to consider whether these do not have a common factor. Probably the only common result of these forces is increased intrathoracic pressure. This might act by temporary compression of the sympathetic trunk or by irritation of the vagus. Either mechanism could give rise to a small pupil. It is conceivable that a tumor mass could be so located in the mediastinum as to compress either of the nerves mentioned. None has been found in this case.

Vegetative Nervous System Mechanism.—Diseases of the vegetative nervous system, aside from endocrinal disturbances, are practically all functional, and are manifested as vegetative imbalance. This gives rise to the well known vagotonia, sympathicotonia and their combinations.

4. Howell: Textbook of Physiology, New York, W. B. Saunders Company, ed. 7, 1918, p. 1059.

Organizing the symptoms already presented under the headings of vagotonia and sympathicotonia, respectively, they appear as follows:

Vagotonia: (1) physical fatigability; (2) dry hair; (3) accommodation spasm on the right; (4) absence of gag reflex; (5) excessive hunger before meals; (6) spasm of the pylorus; (7) excessive tympanitis; (8) hyperinsulinism; (9) hyperidrosis.

Sympathicotonia: (1) mydriasis; (2) rare winking; (3) dryness of the eyeballs; (4) vasoconstriction in the conjunctivae by epinephrine persists for one and one-half hours; (5) accommodation paresis on the left.

The history is important in this respect. In 1921, the patient suffered from a dilatation of the right pupil and micropsia. Fuchs states that micropsia is caused by paresis of accommodation, because the patient judges the size of an object by the force of the impulse required to accommodate. Since in accommodation paresis much force is required, and objects are not as large as the person should expect for that degree of accommodation, the object is judged to be small. The patient under discussion, therefore, had accommodation paresis in the right eye in 1921. He now has accommodation spasm and a smaller pupil. All this would mean that he had a sympathicotonia six years ago and now has a vagotonia on that side. The left pupil, however, is now in the stage of dilatation and accommodation paresis.

The glucose tolerance curves reveal a definite hypoglycemic tendency, and in one test the patient experienced a hypoglycemic (insulin) reaction.

There is one objection to the vegetative imbalance interpretation. Functionally altered pupils will usually react at least to some extent to light. Here the right will not react to light or in convergence. But, on the other hand, it does react to interference with the vagus or sympathetic trunk and the left does react, as we should expect in a functionally dilated pupil, by contracting slightly to light and in convergence.

LEMNISCUS SYMPTOMS FOLLOWING EPIDEMIC ENCEPHALITIS

BILATERAL IMPAIRMENT OF DEEP SENSATION *

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In 1908, Spiller published an article [1] in which he referred to another [2] previously published by him on the symptom-complex produced by occlusion of the posterior inferior cerebellar artery. He pointed out that the lesion was always unilateral and that the lateral portion of the medulla oblongata was involved, whereas the central and anterior parts were not affected, since this area was supplied by a different set of vessels, the anterior spinal arteries and their branches. He suggested, therefore, that if only the anterior spinal arteries were occluded or hemorrhage occurred from them, a very definite symptom-complex should be expected to develop, the complement of that caused by occlusion of the posterior inferior cerebellar artery. He says:

> The anterior spinal arteries arise from the vertebrals about a centimeter before the latter unite to form the basilar. The left anterior spinal artery is frequently the larger, and, according to Duret, the right may be absent. Many of the fibers of the hypoglossus nerves leave the medulla oblongata above the origin of these arteries. Branches of these arteries supply the median portion of the medulla oblongata, especially the lemniscus and the anterior pyramids, although the latter may be nourished also from the vertebral arteries. The important fact is that the area of supply of the upper part of the anterior spinal arteries is chiefly the anterior and middle portions of the medulla oblongata. Occlusion of these arteries or hemorrhage from them, including the adjoining part of the vertebral arteries, should therefore give a very definite symptom-complex. This may be unilateral or bilateral, depending on the union of the two arteries near their origin or several centimeters below. As these arteries are side by side shortly below their origin, even when they do not at once unite, the symptom-complex is likely to be bilateral. We should expect to find paralysis of all the limbs, trunk and neck, while the reflexes necessary to life would be preserved. The face would not be affected. The tongue might escape, as the hypoglossus nerve, or a portion of it at least, has its origin above the origin of the anterior spinal arteries. But it might be involved by implication of the

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* From the neurologic department, University of Pennsylvania Hospital.

* Read before the Philadelphia Neurological Society, November, 1925.

* Read at the Fifty-Second Annual Meeting of the American Neurological Association, Atlantic City, N. J., June 1, 1926.

1. Spiller, W. G.: J. Nerv. & Ment. Dis. **35**:775, 1908.
2. Spiller, W. G.: J. Nerv. & Ment. Dis. **35**:375, 1908.

vertebrals. As the lemniscus probably conveys fibers of deep sensation, this form of sensation would probably be disturbed.

Spiller described a case, without necropsy, in which sensations of touch, pain and temperature were everywhere normal, but the sense of position was distinctly disturbed in the toes and the fingers, especially on the right side. A Babinski reflex was present on the right side. The patient had had an apoplectic attack which occurred suddenly and affected at first both sides of the body simultaneously and equally. The important features of the case were spastic paresis of all limbs, with some disturbance of the sense of position. Two similar cases have also been reported by Wilson.[3]

Recently, Foix, Hillemand and Schalit[4] have described what they term the syndrome of the lateral portion of the bulb. They found a lesion limited to the peripheral portion of one side of the medulla oblongata which they attributed to occlusion of an artery to which they gave the name of the artery of the lateral recess. I call attention to the lateral situation of the lesion in this case because it is stated in the report that thermanesthesia was present, but tactile and deep sensations were normal, and that there was complete integrity of the median portion of the medulla oblongata. The tracts of deep sensation, the posterior longitudinal bundle and the pyramidal tracts, they said, were not implicated in the lesion.

Wilder,[5] while discussing the effects of occlusion of the individual cerebral arteries, refers in the third part of his article to occlusion of the anterior spinal artery. He cites Spiller's case that I have just alluded to and points out that, normally, the anterior spinal arteries arise from the vertebral arteries and unite into a common artery, but not until just before entering the cord, and that it is this united anterior spinal artery that gives off branches to the medulla oblongata. He expresses the opinion that a thrombus forming in the course of one anterior spinal artery, before the union with its fellows has occurred, would rarely lead to softening, and therefore is incapable of producing symptoms. He thinks that symptoms could be produced when the occlusion occurs in the united trunk of the anterior spinal artery, but that even then the softening that might be expected would rarely lead to death. He thus explains the lack of anatomic observations and concludes that the clinical syndrome presented by Spiller as characteristic of the condition is not convincing. Wilder's conclusions seem to be entirely theoretic.

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3. Wilson, George: Spinal and Spinobulbar Tetra-Plegia of Acute and Subacute Onset, Its Causes and Prognosis, J. A. M. A. **78**:713 (March 11) 1922.

4. Foix, Hillemand and Schalit: Rev. neurol. **1**:160 (Feb.) 1925.

5. Wilder: Monatschr. f. Psychiat. u. Neurol. **59**:154, 1925.

Both unilateral and bilateral softenings in the median portion of the medulla oblongata from occlusion of the anterior spinal artery have been observed by Dejerine. In the 1914 edition of his book, "Semiologie des affections du système nerveux," on page 213, he gives a diagrammatic illustration (fig. 49) of a cross section of the medulla oblongata in which a unilateral softening had occurred from occlusion of the left anterior spinal artery. In the legend accompanying the diagram it is stated that the left twelfth nerve was affected, for there was atrophy of the tongue and reaction of degeneration. There was also hemiplegia on the opposite side of the body from implication of the pyramidal tract. Deep sensation was affected on the right side of the body, but without disturbance of pain and temperature sensations. On page 227 of the same volume is given another diagram (fig. 59) showing a similar softening, asymmetrical in outline, that had extended bilaterally from the raphe and had also involved the pyramidal tracts. The legend states that there had been bilateral hemiplegia with paralysis of the twelfth nerve on the right side and impairment of the sense of position in all four limbs. No details of these cases are given in the text.

Jones and Spiller [6] have published observations on a case of epidemic encephalitis with special reference to the central tracts of the nervus vestibularis, with an important finding which has direct bearing on this subject. They say: "There was a limited area of complete degeneration in the center of the tegmentum extending from the lower part of the medulla oblongata well into the lower part of the pons, with the raphe as its center." This degenerated area, as shown on page 343 as figure 2 of their article, appears to belong to the region supplied by the anterior spinal arteries. Although in the notes of the physical examination of the patient no record is made of the condition of the deep sensations (recognition of posture or vibration), it is stated that incoordination was the first symptom noted and there was disturbance of equilibrium in walking. It is also recorded that the patient had said that his legs "felt like sticks," and "as if they did not belong to him."

These phenomena described in the history of the case, if not identical, seem to resemble symptoms that my patients had and that I have attributed to impairment of deep sensation.

In recording the following notes of three cases, I have purposely omitted negative findings. The patients were carefully observed while in the wards of the hospitals, all the laboratory examinations, including examinations of the spinal fluids, were made, and nothing positive was found that is not recorded.

REPORT OF CASES

CASE 1.—Mr. J. H., aged 23, admitted to the University Hospital Oct. 5, 1925, had been confined to bed for two weeks in 1918 with influenza. The symptoms

6. Jones, I. H., and Spiller, W. G.: Brain **48**:334 (Sept.) 1925.

subsided and he seemed to have recovered, but after about two weeks he had a relapse and was again confined to bed for ten days. Diplopia had not been noticed, but he stated that for a while he had been unable to see above the bridge of his nose (I take this to have been due to ptosis). After this he seemed to be quite healthy, but felt weak after exertion. In December, 1923, while doing heavy work as a fireman on a freight engine, he had an attack which he described as twitching movements of the left foot. This disappeared after a few days. He had no additional symptoms until the spring of 1924, when, while walking home, his left leg "suddenly went dead" as he expressed it. He had a numb feeling throughout the leg, but it did not give way beneath him. However, he was compelled to lean against a wall for support and, after resting a few minutes, with difficulty was able to resume his walk to his home, a distance of ten squares. He said that while walking his left leg "would go in the wrong direction" and "would run into the gutter." The numb sensation persisted, but use of the leg gradually improved. About six months after this occurrence, his right arm and hand began to feel dead, "as if the skin was dry" and "as if the skin would crack." He said it was "not much good to him." In putting on his coat he did not know whether he had his right hand in a pocket or in the sleeve. This condition continued for a time, then became less and less pronounced, so that after about five weeks it had almost, if not entirely, disappeared.

In October, 1925, shortly before admission to the hospital, his left hand began to feel dead and numb, so much so that he could not use it properly. On one occasion, while holding a boiled egg in his left hand and trying to open it with his right hand, he unintentionally grasped it too tightly between the left fingers and broke it. He said that he had not appreciated what had happened until he saw the broken egg.

Physical Examination.—The following symptoms were found: Impairment in the sense of position, vibration in all four limbs and spastic paresis of the lower limbs only, with increased tendon reflexes and clonus and a Babinski sign on each side. The abdominal reflexes were absent. Impairment of the sense of position of the great toes of both feet and the fingers of the right hand was not marked, yet very definite. Since admission to the hospital, it seemed to be growing less conspicuous and at the time of this investigation, in the right hand at least, careful examination was required to demonstrate it.

During part of the time when the patient was in the ward, the recognition of position in the fingers of the left hand, and even the position of the whole hand to the wrist was entirely lost. The voluntary movements of the fingers and hands and arms were performed powerfully, but awkwardly, yet motor power was not quite normal. Astereognosis was complete in the left hand. During the last few weeks these phenomena gradually became less and less conspicuous, but could still be demonstrated. Vibratory sensation was impaired in both lower limbs, gradually diminishing toward the trunk, but still demonstrable even in the bones of the pelvis. The lower limbs were only slightly weaker than formerly, but the tendon reflexes were increased on each side and there was a bilateral Babinski sign. There was marked ataxia in walking. All other forms of sensation, including pain, heat, cold and touch and the recognition of two points of contact simultaneously, were entirely normal.

Case 2.—H. M., aged 30, admitted to the University Hospital, Oct. 23, 1925, had been healthy until October, 1923, when he had a severe attack of influenza of five weeks' duration. He seemed to have recovered, but felt tired and became weak after the slightest exertion. In the spring of 1924, he noticed that his left leg was growing weak. This was soon followed by numbness and a feeling of uncer-

tainty when walking. He said it felt as if he were walking on a slippery floor and he was afraid that he might fall. Soon the right leg was similarly affected. This condition gradually grew worse. He said that his knees would give way beneath him, and he did fall to the floor on more than one occasion. In walking with bare feet the soles of his feet felt prickly and he was not quite sure where his feet were. About this time he developed left-sided temporal headache, and diplopia when looking toward the left. He complained of vertigo when walking, and said the "walls seemed to go round and round." His condition became so much worse that he could not walk without support on each side. He then was confined to bed for two weeks. Since then he thought he had improved, but his symptoms had not disappeared.

Physical Examination.—Paralysis of the external rectus muscle of the left eye was present. Vibratory sensation was impaired in both lower limbs, diminishing as the trunk was approached, but including the pelvis. Recognition of position of the great toe was impaired in both feet. He tended to walk to the left and fell to the left when standing with eyes shut. Gait was ataxic and spastic. The tendon reflexes were bilaterally increased, and bilateral ankle clonus and a Babinski sign were present. Muscular power of both lower limbs was impaired. All other forms of sensation were normal. The upper limbs were normal.

CASE 3.—Mrs. M. S., aged 59, admitted to the Presbyterian Hospital, Oct. 27, 1925, and discharged, Nov. 8, 1925, stated that she had been in good health until the spring of 1922, when she contracted a cold. A week or two afterward, though not feeling ill, she developed chills, intense drowsiness and general weakness. This condition rapidly progressed and she thought that she had become stuporous for at least a day. The symptoms then gradually subsided and after two or three weeks she felt well again. Soon after this, however, she noticed an awkwardness when using her right hand which caused her much annoyance in writing and in playing the piano, so much so that writing and playing became exceedingly difficult. This condition persisted. About December, 1924, she noticed awkwardness in using her right leg when walking; she felt unsteady, and her daughter then first noticed that articulation was less distinct than formerly, and that the slightest muscular effort caused undue fatigue. In the spring of 1925, she noticed a disturbance of vision which she stated was because "her eyes would not keep still," and soon after this she developed diplopia when looking toward the left and upward. Her condition remained much the same, but awkwardness in using the right arm and the right leg became slightly more conspicuous, and she developed severe left-sided temporal headache. At the time of admission she had much trouble in writing because when raising the pen above the paper she experienced difficulty in getting it back again to the same spot; for this reason she had given it up. She was afraid to attempt to walk because she had to hold on to something to keep from falling.

Physical Examination.—The following symptoms were found: There was marked bilateral rotary nystagmus; there was weakness of the superior rectus muscle of the left eye; the tongue when protruded deviated to the left, but was not atrophic; muscular power of the upper extremities was nearly normal, but the right arm was less strong than the left, though all movements could be performed with fairly good power; the biceps and triceps reflexes of the left arm were normal, but the right were slightly hyperactive; the fine movements of the right hand were incoordinate; the sense of muscular position and movement in the fingers of the right hand were impaired but not lost; the left hand was normal. Stereognostic perception was normal in the left hand, but the recognition of

objects placed in the right hand seemed to be less acute than in the left hand. Vibratory sensation was normal in the left hand, but was impaired in the right hand. She felt uncertain when standing erect, swayed considerably but did not fall; this was not markedly increased by closing the eyes. When walking she tended to go to the right. The right leg was weaker than the left but was not paralyzed. The patellar and Achilles reflexes were moderately increased on the right and normal on the left. A Babinski sign was present on the right, but not on the left. There was no ankle clonus. The recognition of posture of the great toe was much impaired on the right, but only slightly impaired on the left. Sensation for touch, pain, heat and cold was normal throughout the lower and upper limbs and the trunk, and in the face. She complained of a sticking sensation in the right hand, and a feeling of pins and needles in both feet, especially in the right foot. Vibratory sensation in the legs was impaired as far as the knees: the impairment was greater, however, in the right leg than in the left. The pupils reacted normally to light and in accommodation, and the eyegrounds were normal.

Since discharge from the hospital the patient has developed respiratory symptoms resembling influenza. All her symptoms were reported recently to have progressed considerably.

COMMENT

The mode of onset of the symptoms in these cases, especially in the wake of an attack of "flu" characterized by remissions and exacerbations and associated with ocular paralysis, justifies the opinion that the process was epidemic encephalitis. Bilateral impairment of deep sensation (recognition of position, passive movement and vibration) could then be attributed to a lesion in the medulla oblongata implicating the lemniscus, and the motor symptoms to implication of the pyramidal tracts which lie anterior but adjacent to the lemniscus.

The resemblance of the symptoms to those of multiple sclerosis appear to me striking, not only because of the relapsing character of the onset, but particularly because of the rapidity of the onset and the intense disability that developed, especially in the hands of the first case, which was probably due chiefly to loss of deep sensation and not to motor paralysis.

Birley and Dudgeon [7] have emphasized the frequency of disturbances of deep sensation in disseminated sclerosis, and say:

We should like to draw attention to a symptom-complex first described by Oppenheim which may be called the "useless arm." The condition usually develops rapidly in the course of a few hours or days, with or without preliminary warnings such as paresthesia. As a rule it is unilateral, and the expression used by the patient to describe the condition is almost invariably the same, viz.: "the arm is useless." Objectively there is profound loss of deep sensation in one of the upper extremities; no threshold to compass, complete astereognosis; no response to vibration; wild sensory ataxia, with abolition of the sense of passive movement, sometimes complete even at the shoulder joint. Hence the patient says: "I lose my arm in bed." The limb is not paralyzed if he gazes fixedly at the arm. When

7. Birley, J. L., and Dudgeon, L. S.: Brain **44**:150 (July) 1921.

each muscle group is tested there is no loss of power, but with closed eyes there is an apparent paresis which is, however, entirely due to the falling out of afferent impulses from muscles and joints, and consequent inability to apply muscular power. This curious condition may be the first and only evidence of disseminated sclerosis. We regard the condition as the result of an acute, but not necessarily destructive, lesion in the external portion of the homolateral posterior column of the upper cervical cord or its continuations.

I presume they must mean by this last statement the lemniscus. It appears that loss of deep sensation may produce disability so severe that, in the beginning at least, it might even be mistaken for actual motor weakness. It seems to me, however, that it is the abruptness with which the loss of deep sensation occurred in these cases that was the necessary requisite for the production of such intense phenomena, for there was a decided tendency to recover though the symptoms did not disappear. I [8] have seen a similar condition affecting the lower limbs in a case of tabes when ataxia developed suddenly.

It has been demonstrated experimentally by Sherrington that the upper limb becomes motionless after cutting all the posterior spinal roots that connect the brachial plexus. It is logical, therefore, to assume that such phenomena as occurred in my cases, even though transitory, can also be produced by implication of the lemniscus, especially when they occur bilaterally and affect all four limbs simultaneously.

On account of the associated motor weakness of the legs, the complete clinical picture resembles that of posterolateral sclerosis of spinal origin, so frequently caused by syphilis or associated with anemia. But these diseases, I think, can be excluded. Since, however, the upper limbs were not affected at all in case 2, the diagnosis of a lesion in the medulla oblongata may appear doubtful. Nevertheless, it does not seem unreasonable to accept the view that the continuations of the fibers that make up the columns of Goll and Burdach in the spinal cord, which are represented by the fibers that arise from the nucleus gracilis and nucleus cuneatus in the medulla oblongata, in their passage toward the midline, are separated, and remain distinct even after having entered the raphe; and thus those that convey deep sensation to the upper limbs may not have been implicated in this lesion. A similar explanation was offered by Breuer and Marburg [9] in alluding to the escape of the leg in a case of occlusion of the posterior inferior cerebellar artery. They believed that the fibers of deep sensation for the arm had been implicated in their case, especially because they arise from Burdach's nucleus which is more exterior.

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8. Cadwalader, W. B.: Character of Onset of Spinal Paralysis with Reference to Significance of Apoplectiform Type of Onset in Contrast to Slow Progressive Development of Paralysis, Arch. Neurol. & Psychiat. **6**:541 (Nov.) 1921.

9. Breuer and Marburg: Obersteiner's Arb. **9**:181, 1902.

In spite of the fact that complete anatomic studies of carefully examined clinical cases of this kind do not seem to have been recorded, I am convinced that it is not because they are rare, but because they have been overlooked, and that in the course of time the syndrome first considered by Spiller as probable will be fully substantiated on an anatomic basis.

NOTE.—Since the preparation of this article, I have had under observation, in the University Hospital, a case regarded as one of multiple sclerosis. The history and symptoms resembled those of case 1. Because of intense impairment of deep sensation, the patient's left hand had become practically useless; after two months had elapsed, almost complete recovery occurred spontaneously, though ocular symptoms and motor symptoms of the lower limbs persisted.

DISCUSSION

DR. WILLIAM G. SPILLER, Philadelphia: It is important to call attention to these cases and to the means of differentiating them from posterolateral sclerosis. It is likely that some cases which have been diagnosed as posterolateral sclerosis occur in patients with lesions in the medulla oblongata, involving the anterior pyramids and the lemniscus.

METHODS OF PREVENTING DELINQUENCY *

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All of us, I think, will agree that most of the existing machinery dealing with delinquency and crime is set up to handle end-results and that there is little of a preventive nature in it. Public interest is largely centered about these old and tried methods and society as a whole is apparently satisfied with conditions as they are. From time to time so-called "crime waves" bring forth enthusiastic reformers and amateur criminologists who point out failures in the prevailing methods and offer new remedies for handling and preventing crime by the same antiquated machinery. Occasionally an ambitious psychiatrist suggests a method of dealing with the situation and recommends that the whole procedure should be turned over to his specialty. As a rule, however, these critics make little impression on politically minded laymen in whose hands the whole matter rests.

Perhaps when we think in fundamental terms of actually preventing delinquency the psychiatrist's chief interest in this set-up is that of a citizen and taxpayer and the possibility it offers for his specialty to do certain educational work. Certainly, this machinery as it exists today does not seem to offer much opportunity for applying the scientific principles of psychiatry in the prevention of delinquency. Our efforts to date in court have been anything but satisfactory even to those who have performed there. Public opinion and the legal profession are somewhat suspicious of us. Undoubtedly there have been instances in which psychiatrists have plunged into situations without having carefully studied or understood the various interrelations and the backgrounds involved. Our knowledge of behavior problems has rapidly increased in recent years and our understanding of the delinquent's make-up and motivations greatly overbalances our capacity for his treatment when other than purely psychiatric factors are involved.

Practically all scientific medicine has developed its preventive principles from proceedings over the necropsy table, from under the microscope, from bedside observation and in general from clinical study. Our psychiatric progress similarly has extended over a number of years from its beginnings in the asylum to the formulation of certain mental hygiene

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* Read at the Meeting of American Orthopsychiatric Association, New York, June 6, 1926.

principles for handling childhood problems. Modern psychiatry, like public health work, has other than bedside features. We think of psychiatry as a specialty dealing with the various problems of behavior and we recognize the fact that mental disease and delinquency spring from related roots. Many of the flaws in our psychiatric technic in the delinquency field we have inherited from our work in mental diseases, and not the least of these is the rather narrow and air-tight compartments in which we have worked and an attitude we have assumed in believing psychiatry a self-sufficient science. We fail at times to recognize its limitations, to seek cooperation from allied professional fields and to do the real clinical job necessary actually to get at the underlying causes.

Many studies have been made of the inmates of jails, reformatories and penal institutions and all of these studies reveal easily classifiable and advanced psychiatric problems. To be sure, psychiatric clinics have been established in the courts. Clinical work has been initiated in school systems; psychiatrists are going into colleges to work with the student material there, and psychiatry is more or less penetrating industry. All this work is to be commended and should be more general instead of enjoying, as it does, a rather isolated existence. We should not, however, feel satisfied that these advances are actually going to prevent delinquency. This progress is of an external nature and consists largely of treating symptoms of maladjustments more deeply rooted in our social system. To prevent these personality and behavior difficulties the work should be started with children before they are misfits in colleges and industry and before they are brought to court or located in prison.

There is a small number of clinical groups intensively studying the causes and prevention of delinquency. Dr. Healy's pioneer activities in Chicago, and the work he is now carrying on in Boston, are perhaps the best examples of a small beginning, of staying with one's job, of studying and building and working quietly at certain cause and effect relationships and formulating constructive ideas about the study and treatment of juvenile delinquency. Dr. Adler, by combining his work as director of the Institute for Juvenile Research in Chicago and his position of criminologist of Illinois, has exerted a tremendous influence over the work of public and private institutions and agencies in Illinois and has stimulated a great deal of interest elsewhere. Public approval of Dr. Adler's work has been practically expressed by the raising of funds to establish his research work on a more permanent basis. Dr. Thom of Boston has made an important educational contribution by bringing to public attention the need of recognizing and properly handling the habit difficulties of younger children. His cases, while the children concerned are not obviously delinquent, undoubtedly are forerunners of more serious behavior problems and his work is essentially preventive. The Division on Prevention of Delinquency of the National Committee

for Mental Hygiene has utilized some of the methods formulated by Healy, Adler and Thom in demonstrating child guidance work in cities throughout the country.

These modern clinical centers are dealing for the most part with incipient problems and are attempting to treat the individual in relation to his environment, both human and material. Social workers, psychologists and physicians are working together in the study and treatment of the whole child in his entire environment.

For the most part all children's problems originate in the home, school or community, and it is the various ramifications of problems encountered in these situations that handicap us in treatment. It is an established fact that children may become behavior problems because of conflicts arising from home situations in which quarreling, disagreement in discipline and other incompatibilities take place between parents. Difficulties with other brothers and sisters arising from favoritism, jealousy, etc., are sometimes factors. Sex curiosity, exposure, enuresis, masturbation and other sex experiences badly handled by parents frequently contribute to mental conflicts. Lack of habit training in such simple routine matters as eating, sleeping and playing, inconsistent discipline, poor example, etc., may be the starting point for serious trouble. Physical ill-health, associated with fatigue, encephalitis, endocrine disorders, etc., may account for unusual behavior reactions. Social inadequacy, illness in the family, industrial depression and strikes may cause stress in the home and may have a direct bearing on the beginning of behavior problems in children.

In making the transfer from home to school new adjustments are necessary on the part of the child. However, he usually plunges into this new environment with all of his successful pet methods and habits brought from the home. The teacher as a rule knows nothing about what the child is like or what he was subjected to before entering school. The child is severely checked by the school discipline and must adjust himself somehow to this new authority exerted over a miscellaneous group of from thirty to forty-five youngsters in the classroom. He may be unable to adapt himself to all this; he may get along unsatisfactorily with other pupils; he may need individual handling; but he is made to conform to group action. It matters little whether the child is intellectually retarded or superior; poor grading and the lack of a flexible curriculum may be his stumbling block. Should these earlier situations in his school career not make him a problem, he is likely to be confronted with serious adaptations involved with adolescence or an unsuitable choice of vocation. Even if teachers were better acquainted with child psychology and mental hygiene principles there would be little opportunity for individual help because of overcrowded classrooms, and few school systems have access

to the home through visiting teachers. Schools for the most part are without special facilities for determining special educational abilities or disabilities, vocational guidance or training in the trades, and special classes for opportunity and adjustment cases.

Should the child escape home and school situations without becoming a behavior problem there remains a community life with dangers of various sorts which he must face. Gang life may appeal to him either as a leader or a tool of the group; associated closely with the gang element may be the lack of healthy outlets in the way of recreational facilities; school attendance and child labor laws may be involved in one way or another; child placing and family case work agencies may be undeveloped and may further handicap the situation; blind alley jobs for youngsters in industry, poor housing and sanitation, unassimilated foreign groups and economic depressions in the community, individually or collectively, may unfavorably affect the child's development, either directly or through their effect on his family, and limit our possibilities for treatment.

On the whole, parents have little idea of wholesome discipline and authority. As a matter of fact, the average parent has had little opportunity to acquire the modern point of view. Prevalent religious concepts, old-fashioned educational backgrounds and the average family's relationships are all opposed to dealing in a scientific way with the problems of the child. Many parents believe their children's problems are trivial, and an expectation that they will "outgrow" these traits prevails. "Spare the rod and spoil the child" has not been replaced in the family code by an attempt to understand the child and his needs. It is with these problems the social worker and psychiatrist are coping in an effort to remedy the individual home situations from which problem children come, by putting over a psychiatric point of view to parents about themselves and their children. The same sort of approach is made in the educational system to the individual teacher whose pupil is the problem. Psychologic and educational studies, when combined with social, medical and psychiatric observations, frequently indicate the pressing need for the teacher to modify her methods of disciplining the child and for grade and subject adjustment to meet the child's intellectual capacity. In the community the clinic does what it can to divert the child from his gang associations by tying him up with supervised recreation, keeping him busy in a suitable job and persuading his family to further normal play interests.

So far we have been able to deal only with the various home, school and community situations in relation to our individual cases. We have our measure of success, and even in handling individual cases with parents, teachers and others we are gradually affecting more children than those with whom we immediately deal. The question arises whether

we should be content with prevention on this small scale. It is obvious that we are struggling against the whole current of a society organized along unpsychiatric lines and obstinately opposing our efforts at treatment. We are, of course, making headway by continuous sustained effort and by meeting individual relapses during the course of treatment. Social agencies, schools, courts, institutions and parents, here and there, have manifested an interest in the work; a more intelligent type of trained personnel is being employed in these groups and the development of adequate facilities to deal with the earlier problems is gaining ground. We can accept the fact that educational work is a slow and tedious process. After all, what has been accomplished is due to sticking with our own jobs and working out individual adjustments in the community.

For the most part our attack on the larger aspects of the problems of delinquency has been external and in the interest of individual cases. This individual work is essential,but when it comes to dealing with the whole problem of preventing delinquency we are actually doing little more than scratching the surface because of our limited knowledge of other related endeavors and the lack of functional relations with various allied fields. The psychiatric group should not be satisfied with the existing situation, although valuable and constructive work is being done. The broader implications of psychiatry in the problems of delinquency must be taken into consideration and an effort made to engage the interest of workers in all fields involving the daily life of the individual if cross currents are to be eliminated and psychiatry is to take part in solving the underlying problems that are impeding our progress. We are not going to do a great deal about methods of preventing delinquency until we recognize that the best methods for preventing it will have to be evolved through fundamental modifications in educational methods, housing plans, social relationships, dealing with the unassimilated alien, court procedures, industrial organization, etc. Our individual case work has taught us that our greatest frustration arises from the fact that we are not pedagogues, sociologists, lawyers, business managers, etc., that we do not understand their jobs and cannot talk their language, see the problems they see and offer constructive suggestions, because they are inclined to regard us as intruders. We need to recognize our limitations and persuade these groups, who after all really control the social system, to let us learn their game. We need to know more about their technics, their aims, the conditions under which they work and then attempt cooperation in a common cause from the inside. We ourselves would have a more effective psychiatry if we had such an interchange with these fields and embodied in psychiatry what they have to offer us and that which they are more responsible for than are we. Many of the roots and remedies for psychiatric problems are in

other social fields, and we must recognize this fact even at the expense of our present self-sufficiency. The great problem confronting us is how we can best bring about assimilation of the psychiatric point of view into these agencies and promote the development of their methods in harmony with the psychiatric needs of individuals. After all, psychiatry does not deal with a separate compartment of the person's life but with all those forces which operate to make that life what it is. We cannot take over these other fields but we should be ready to understand enough of their philosophy and working methods to make possible common thinking. This is not work for the individual psychiatrist to undertake but it should be a part of the program of a group such as the American Orthopsychiatric Association.

Take as an example what has been done in the field of education. Educational clinics have been established to determine the child's intelligence and educational capacity; a few school clinics definitely treat behavior problems; a number of school systems have accepted the visiting teacher as a necessary link between the school and home; many progressive school boards are supporting special departments of research. But in the actual planning of curriculum and study of educational methods, the mental hygienist has played a minor rôle. There has been considerable discussion among educators of the obligation of the school to teach mental hygiene, and for the most part the plans suggested have been concerned with special courses, as if mental hygiene were a thing apart from the ordinary content of education. Without a doubt the psychiatric contribution to education rests on our mastering some of the details of pedagogy, the problems of school administration and the training of teachers, so that into these may be assimilated a psychiatric point of view that will make mental hygiene in the schools a part of the school atmosphere and not an external and clumsy corrective to all that is essentially unpsychiatric in the rest of the school's activities. Perhaps the most interesting development in the field of education, so far as our subject is concerned, was the appointment last year by the National Education Association and the National Conference of Social Work of a joint committee composed of educators, social workers, sociologists, criminologists, judges, psychologists and psychiatrists to study their common problems in preventing and treating juvenile delinquency. This committee has been making a survey of the problems of the educational field in their relation to those of extra-educational agencies and will undoubtedly proceed to investigate further the cross-purposes obvious in the activities of each group.

Some action of the same sort has long been recognized as necessary for reconciliation of the purposes of psychiatry and the law. In industry a beginning has been made through several clinical projects handling individual cases but no psychiatric group has as yet taken up the problems

of industry in their larger aspects of industrial management and engineering, and little has been done to investigate the mental hygiene aspects of modern industrial methods. We have, perhaps, accepted industrial conditions as inevitable but industrialists themselves have been experimental.

What we need if we are really to evolve methods of preventing delinquency is orientation in the methods of those fields which affect so vitally the adjustive possibilities of every person. There is an undoubted necessity for treating individual cases of yellow fever but we cannot rest content with achievement on this scale and overlook the necessity for eradicating the mosquito. The sources of delinquency are not in psychiatry itself, and if psychiatry is to be preventive it must penetrate those fields that are a part of the normal life of every person.

THE WEIGHT OF THE HEART IN SCHIZOPHRENIA AND IN OTHER MENTAL DISORDERS *

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Interest has been displayed in the constitutional factors which might be involved in schizophrenia, and with this interest has come the publication of studies concerning gross atrophies [1] and histologic studies by Southard and Canavan,[2] Mott [3] and others. Southard,[4] in 1910, as the result of his investigations, stated that the "evidence for the organic nature of dementia praecox was not wholly convincing." He found, however, a greater number of anomalies, external, visceral and cerebral, in schizophrenia than in the senile psychoses, the epilepsies and general paralysis, schizophrenia being second only to feeblemindedness in this respect. Attention has been focussed on the gonads [3] and other ductless glands in connection with the increased interest in endocrines. Cotton [5] has reported a large percentage of recoveries of so-called "functional mental disorder" after the removal of foci of infection, and lays special stress on such infections in causing mental disease.

Circulatory phenomena, such as the cyanosis of extremities observed in schizophrenic patients, have brought the cardiovascular system into the psychiatric limelight.[6] Lewis,[7] from a large series of necropsies

* From the Neuropathological Laboratory of the Massachusetts Department of Mental Diseases.

1. Southard, E. E.: On the Topographical Distribution of Cortex Lesions and Anomalies in Dementia Praecox with Some Account of Their Functional Significance, Am. J. Insan. **71**:383 and 603, 1914. Taft, A. E., and Morse, M. E.: Hemiatrophy of the Cerebellum in a Case of Late Catatonia, J. Nerv. & Ment. Dis. **41**:553 (Sept.) 1914.

2. Southard, E. E., and Canavan, M. M.: Focal Lesions of the Cortex of the Left Angular Gyrus in Two Cases of Late Catatonia, Am. J. Insan. **72**:553 (Jan.) 1916.

3. Mott, F. W., and Such, M. P.: Further Pathological Studies in Dementia Praecox, Especially in Relation to the Interstitial Cells of Leydig, Dementia Praecox Stud. **5**:47 (April) 1922.

4. Southard, E. E.: A Study of the Dementia Praecox Group in the Light of Certain Cases Showing Anomalies or Scleroses in Particular Brain Regions, Am. J. Insan. **67**:172 (July) 1910.

5. Cotton, H. A.: The Defective Delinquent and Insane, Princeton, N. J., Princeton University Press, 1921; The Relation of Focal Infections to Their Causation—Treatment and Prevention, ibid.

6. Cornell, W. B.: Cyanosis in Dementia Praecox, J. A. M. A. **59**:2208-2209 (Dec. 21) 1912.

7. Lewis, N. D. C.: The Constitutional Factors in Dementia Praecox, Nerv. & Ment. Dis. Monograph Series, 1921, no. 35, 1923, p. 124.

performed at St. Elizabeth's Hospital, concluded that "generally speaking, a small circulatory system was discovered to be characteristic of the dementia praecox group, this constitutional factor being independent of age, color, sex, duration of psychosis or associated diseases." In a series of ninety cases, as given in table 6 of his paper, he found that 75.5 per cent of the cases diagnosed as dementia praecox showed at necropsy hearts weighing less than the average, while a much smaller percentage of such hearts was found in other psychoses. He takes the average heart weight to be 300 Gm.

The series of cases to be considered in this paper is that of the Pathological Laboratory of the Massachusetts Department of Mental Diseases. Statistics are sometimes unreliable and misleading and in presenting data dealing with the mental disease under consideration it must be realized that: 1. Some clinicians consider the catatonic and hebephernic forms of dementia praecox as related to each other, and believe the paranoid type to be quite a different reaction. 2. In such a large series of cases, it must be borne in mind that the diagnoses have been made by different persons. However, they have all come from hospitals under one administrative scheme, and there is no reason to suppose that a serious error occurs in this connection, especially as such diagnoses are considered acceptable for general statistical work. On the other hand, all the postmortem examinations, with only few exceptions, were performed by one pathologist, Dr. M. M. Canavan.

The data presented concern the heart weights from 540 psychotic cases as shown in table 1.

TABLE 1.—*Classification of the Five Hundred and Forty Psychotic Cases Presented* *

No. of Cases		Males	Females
179	Schizophrenia	83	96
102	General paralysis	81	21
43	Cyclothymia	16	27
81	Epilepsy	47	34
61	Focal brain disease (chiefly arteriosclerosis)	41	20
74	Senile psychoses	34	40

* Alcoholic cases were omitted because of the small number in our records.

As a control series I have taken the necropsy records of 495 general hospital cases (the Boston City Hospital) in which the patients were stated to be sane.

In regard to the weight of the heart the men and women should be considered separately because of the normal difference in weight in the two sexes; but for purposes of comparison with Lewis' work table 2, which groups the two together, may be presented.

Though in our series the percentage of schizophrenic patients with hearts weighing less than 300 Gm. is larger than that in any other group (56), it does not approach the figure of Lewis (75.5). Only the

hearts of 49 per cent of the schizophrenic men, but of 66 per cent of the women, were under 300 Gm. That the small weight is not due to the early age at death in schizophrenia would seem to be indicated by table 3.

It is of interest that the average ages at death for the general hospital group is 43 for men and 40 for women, whereas the average age for psychotic men was 53 and for women 56 years. The longevity of the latter may be due to the even existence of many patients in state hospitals. Also, they are not exposed to the multiplicity of dangers to life which the average citizen encounters.

The health of a state hospital patient is more systematically supervised than that of the general hospital patient because routine physical

TABLE 2.—*Percentages of Hearts Weighing Less Than the Average Three Hundred Grams (Lewis)*

	200 Gm. or Less		0 to 300 Gm.		Less than 300 Gm., Both Sexes Combined
	Male	Female	Male	Female	
Schizophrenia	12	20	49	66	56
General paralysis	0.6	24	40	86	50
Epilepsy	0.6	21	32	68	47
Cyclothymia	0	11	38	45	42
Senile psychoses	0	1	24	45	35
Focal brain disease	1	0.5	15	60	31
General hospital cases	0.3	5	27	51	34

TABLE 3.—*Average Age of Patients at Death*

Epilepsy		Syphilis		Schizophrenia		Cyclothymia		Focal Brain Disease		Senile Psychoses	
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
46	41	47.5	47	50	52.6	63	56.4	62	63.5	74.6	74.5

examinations are made; the majority of general hospital patients are admitted for acute illness and have had in many cases no systematized medical attention during the years previous to death. The psychotic women are longer lived than the men, whereas sane women tend to die younger than sane men. The reason may be that the mortality of child bearing is eliminated in the state hospital population.

Our series proves no exception to the rule that heart weights in women are less than those in men. Taking the average weights for all ages of the psychotic group (540 cases), we see an average of 344 Gm. for men and 295 Gm. for women, with a difference in weight of 49 Gm. In the "sane" group (495 cases), the average is 365 Gm. for the men and 310 for the women, with a difference in weight of 55 Gm.

Considering the psychotic cases according to mental disease groups, there is a difference in heart weight for the sexes from 76 Gm. in the neurosyphilitic group to 32 Gm. in the senile group.

Aside from the fact that there is an accepted normal difference in weight, heart weights should be considered separately for the two sexes because in general paralysis there are more men than women; if data for both sexes were combined it would tend to raise the average; in the cyclothymic group the women predominate, thus tending to lower the average weight if the sexes are not separated. In our series the number of schizophrenic women was thirteen more than that of the men; this would also tend to lower the average weight of the heart if the sexes were considered together. This is shown also by the fact that if the sexes are considered together the combined average weight of the heart of the schizophrenic group is 307 Gm. and of the epileptic group 305, less than that of the neurosyphilitic group (314 Gm.), though if the sexes are considered separately the average for both men and women is less in the neurosyphilitic than in the schizophrenic or the epileptic group.

TABLE 4.—*Average Heart Weight in the Psychoses*

	Neuro-syphilis		Focal Brain Disease		Epilepsy		Cyclothymia		Schizo-phrenia		Senile Psychoses	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	330	254	383	311	334	273	369	310	331	287	367	335
Difference in grams.....	76		72		61		59		44		32	

Other factors should be considered in dealing with heart weights:

1. The heart is a muscular organ. Muscles are known to hypertrophy when exercised greatly and to become atrophic from disuse. The lowest average weights for males occur in schizophrenia and general paralysis. There is such a small number of female general paralysis cases that any conclusions drawn from such a small series would be unfair. Patients with neurosyphilis during the late stages are frequently bedridden. This, together with the fact that the majority of general paralytic patients die in the fourth and fifth decades, may account for the fact that the figures approach those for schizophrenia. Many schizophrenic patients lead a vegetative existence and take a minimum amount of exercise. Is it unreasonable to believe the heart capable of maintaining a proportional normal weight since strenuous exercise can be eliminated as a cause of possible hypertrophy?

2. That the heart enlarges with age is well known. Cunningham[8] states that there is an increase up to 70 years. Bell and Hartzell,[9] in a

8. Robinson, Arthur: Cunningham's Textbook of Anatomy, New York, William Wood & Co., 1923, p. 876.

9. Bell, E. T., and Hartzell, T. B.: Studies on Hypertension: The Relation of Age to the Size of the Heart, J. M. Research **44**:473-488 (June) 1924.

TABLE 5.—*Psychotic Men—Average Heart Weights by Decades of Age at Death*

	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91+
Schizophrenia	277	290	319	351	373	398	347*	...
General paralysis	295	327	324	337	361	...	...	...
Cyclothymia	...	260	320	310	310	549	340*	...
Epilepsy	277	321	325	333	405	412	333	...
Focal brain disease	...	...	339	344	400	425	399	...
Senile psychoses	...	...	...	...	353	375	382	...

* Only one or two cases in this decade.

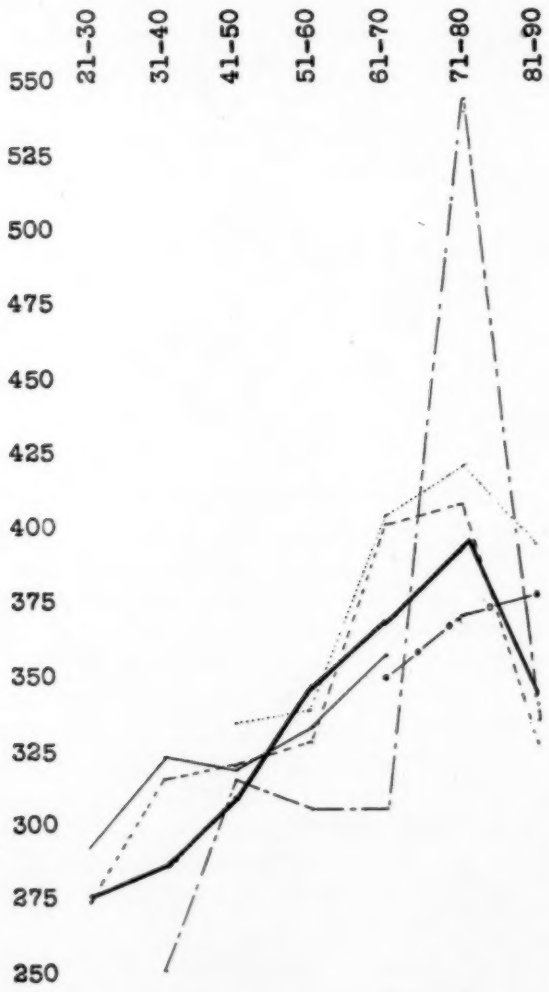

Chart 1.—Average heart weights in psychotic men by decades of age at death; in this chart and chart 2, the heavy line indicates schizophrenia; light line, general paralysis; dash and dot, cyclothymia; broken line, epilepsy; dotted line, focal brain disease; line and circle, senile psychoses.

TABLE 6.—*Psychotic Women—Average Heart Weights by Decades of Age at Death*

	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91+
Schizophrenia	216	232	296	290	301	319	...	...
General paralysis	250	242	255	274	...	...	...	...
Cyclothymia	...	273	308	311	320	...	...	...
Epilepsy	248	240	268	339	279	208	...	...
Focal brain disease	...	320	300*	294	285	348	340	245*
Senile psychoses	...	...	...	...	376	319	309	271

* Only one or two cases in this decade.

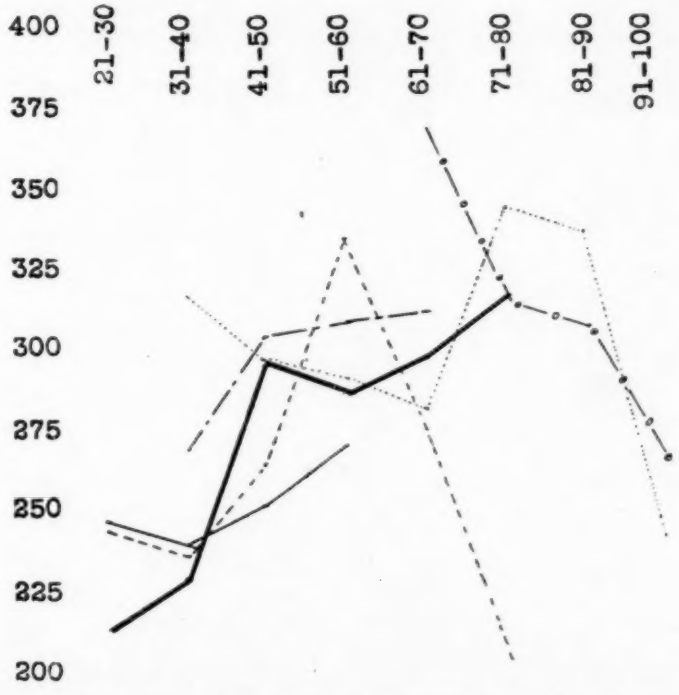

Chart 2.—Average heart weight in psychotic women by decades of age at death.

large series of cases, record that even when all cases of chronic valvular disease, adherent pericardium and syphilis of the arch with involvement of the aortic ring have been excluded, "there is a progressive increase in the average weight of the heart in males from the third to the seventh decade" and in females up to and including the fifth decade.

In our series the neurosyphilitic group (102 cases), in spite of the fact that there may be included some cases of syphilis of the arch, has the lowest average weights for men and for women, and has also the lowest average age at death.

The focal brain disease group, which has an average age at death of 62 for men and 63.5 for women, has the highest average heart weight for the two sexes combined—364 Gm. The average age of this group is at the peak of the wave according to the work of Bell and Hartzell quoted above.

TABLE 7.—*Heart Weights from General Hospital Cases (Four Hundred and Ninety-Five)*

	21-30	31-40	41-50	51-60	61-70	71-80
Male	321	350	376	398	408	368
Female	270	305	337	373	290	298

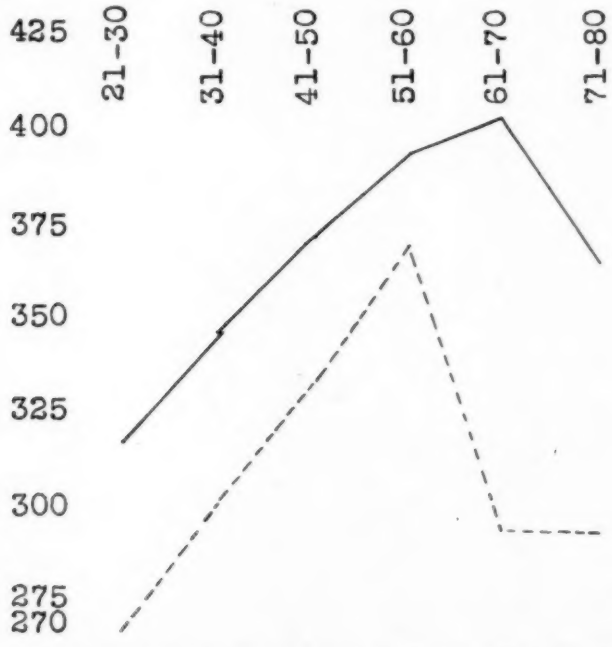

Chart 3.—Heart weights from general hospital cases (495); in this chart and chart 4, the solid line indicates male, and the broken line female, patients.

The senile group has the next highest average heart weight, 349 Gm. This group is on the declining side of the weight peak which comes with increasing age.

Tables 5 and 6 show in greater detail the variations in the average heart weights according to decades.

Table 7 gives the average heart weights for sane men and women according to decades. The curves below show more graphically an increase of heart weight in men through the sixth decades and in women through the fifth decade.

Table 8, from the psychotic group, shows the peak of the weight curve for men in the seventh decade and for women in the sixth.

TABLE 8.—*Psychotic Heart Weights (Five Hundred and Forty Cases)*

	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
Male	308	330	329	344	375	410	378	...
Female	228	245	287	308	327	316	304	268

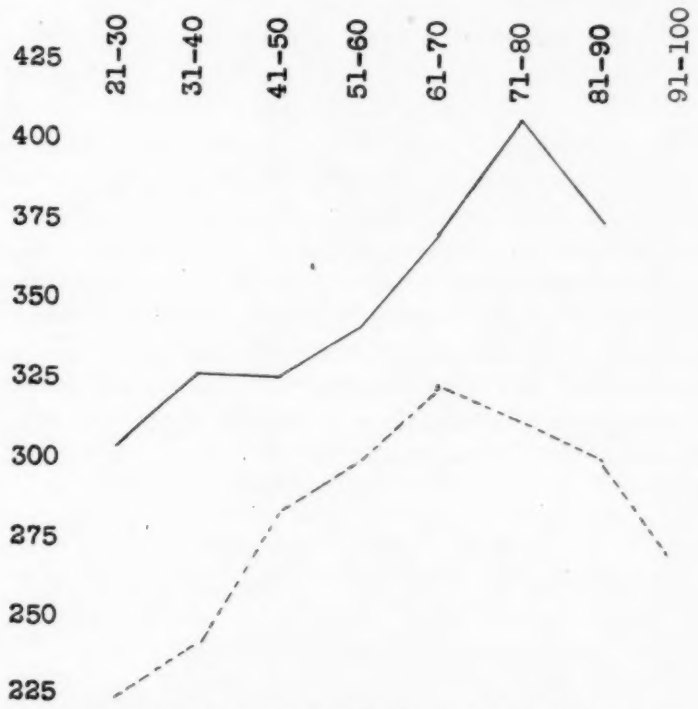

Chart 4.—Psychotic heart weights in five hundred and forty cases.

SUMMARY AND CONCLUSIONS

1. A consideration of 540 psychotic cases submitted to necropsy in the state hospitals of Massachusetts shows 56 per cent of the 179 cases of schizophrenia with hearts weighing less than 300 Gm., 49 per cent of the men, but 66 per cent of the women. (Lewis found 75.5 per cent.)

2. A control series of (495) necropsies from the records of the Boston City Hospital shows: 21 per cent of the men and 51 per cent of the women had hearts weighing less than 300 Gm.

3. The age at death in the state hospital group is greater than that in the general hospital group, said to be sane. The average age at death for sane men was 43; for women, 40; the psychotic men averaged 53; the women, 56.

4. Men and women are considered separately because: (*a*) of the normal difference in the weight of the heart for the two sexes; (*b*) of the preponderance of one sex over the other in certain psychotic groups. (Lewis considers the two together in obtaining the percentage of hearts weighing less than 300 Gm.)

5. In psychotic patients there is a difference in the weight of the heart for the two sexes, varying from 32 Gm. in the senile to 76 in the neurosyphilitic group.

6. The cases are studied as to age at death by decades.

7. The data bear out anatomic investigations which show that the weight of the heart increases with age up to a point and then decreases.

8. The neurosyphilitic group with the lowest age at death has also the lowest average weight of the heart for both men and women.

9. The focal brain disease group which has an average age at death of 62 for men and 63.5 for women is at the height of the weight curve and has the highest average weight for the two sexes, though the senile women have a somewhat higher average than those of the focal group.

10. Hearts of psychotic patients grouped together undergo the same changes in weight with increasing age, as do those of sane persons.

11. Schizophrenia in this series is no exception to this rule, maintaining a middle course throughout as compared with the other psychoses.

DENTAL SENSATION IN SYPHILIS OF THE CENTRAL NERVOUS SYSTEM

CLINICAL FINDINGS IN TABES DORSALIS AND IN GENERAL PARALYSIS

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PHILADELPHIA

Affections of the cranial nerves are of especial interest in the diagnosis of syphilis of the central nervous system. Little attention, however, has been paid to abnormal dental sensation in this disease. A few such cases have been reported: Oppenheim [1] cites one case of degeneration of the gasserian ganglion and the dental nerve fibers. Misch [2] has stated that pain loss in manipulation and especially in extraction of the teeth should direct suspicion to tabes dorsalis. He quotes Kaposi and Port,[3] Merkle [4] and Kronfeld [5] as stating that decrease in pain sense in the tooth pulp may be taken as an early symptom of this disease. Prinz [6] has called our attention to a number of apparently normal patients in whom he found abnormal dental sensation, who later developed typical signs and symptoms of tabes dorsalis.

Thus far twenty-four cases of advanced tabes dorsalis and eight cases of general paralysis have come under observation. With two exceptions dental sensation was diminished or absent.

METHOD

The method used in testing sensation of the tooth pulp was as follows: With a number 1 rose head. burr, the pulp chamber was entered from the labial surface of a vital tooth. The friction produced by the revolving burr would have given a pronounced heat sensation

1. Oppenheim, H.: Textbook of Nervous Diseases, ed. 5, **1**:166, 1911.
2. Misch, J.: Grenzgebiete der Medizin und Zahnheilkunde, Leipsiz. **1**:559, 1923.
3. Kaposi and Port: Chirurgie der Mundhohle, Wiesbaden, 1912, p. 240.
4. Merkle: Kiefernekrose nach Tabes, Deutsche Monatschr. f. Zahnh. **28**: 663, 1910.
5. Kronfeld: Die dentalen Symptoms des Diabetes mellitus und der Tabes dorsalis, Wien. med. Presse, 1901; abstr. Deutsche Monatschr. f. Zahnh. **20**:138, 1902.
6. Prinz, H.: Diseases of the Soft Structures of the Teeth and Their Treatment, ed. 1, 1922, p. 127.

had the pulps been normal. When pressure was exerted near the dentino-enamel junction, an attempt was made to see if sensation was experienced by transmitting this pressure through the lymph present in the dental tubuli. The sensation of touch was tested by gently touching the tooth. This was done to determine if the nerve supplying the pericementum (the investing soft tissues immediately surrounding the tooth) was affected. Pressure and touch sensations were further tested by using a fine pointed explorer which was inserted into the artificially established cavity. As a final check each patient and five additional subjects were submitted to the faradic current test for the vitality of the

TABLE 1.—*Symptoms and Findings in*

Case	1	2	3	4	5	6	7	8
Color	W	W	W	W	W	W	W	W
Age	54	45	40	49	49	40	43	55
Years since chancre	18	25	..	15	30	15	18	25
Deep reflex disturbances	+	+	+	+	+	+	+	+
Sensory disturbances	+	+	+	+	+	+	+	..
Lightning pains	+	+	+	..	+	+	+	+
Positive Romberg sign	+	..	..	+	..	+	+	+
Ataxia	+	..	+	..	+	+	..	+
Bladder weakness	..	+	..	+	..	+	..	..
Parasthesias	+	..	..	..	..	+	..	+
Anal sphincter weakness	..	+	..	..	+	..	..	..
Sexual impotence	..	..	+	..	..	..	+	..
Gastric crisis	..	..	+	..	..	..	+	..
Gastric pains	..	..	..	..	+	..	+	..
Girdle sensation	..	..	..	+	..	..	..	..
Precordial pain	..	+	..	+	..	..	+	..
Charcot joints	+	+	..	..	..	+	..	..
Trophic ulcers	..	..	..	..	..	..	..	..
Optic atrophy	..	..	..	..	..	..	..	..
Failing vision	..	..	..	..	..	..	..	..
Cranial Nerves:								
Pupillary disturbances	..	+	+	+	+	+	+	..
Ptosis	..	..	..	..	..	..	+	..
Difficulty in hearing	..	..	..	..	..	..	..	+
Difficulty in talking	..	..	..	..	..	..	..	+
Serology:								
Colloidal gold reaction	..	..	3444554430	0	4445564310	..	4555554411	0
Blood—Cholesterin antigen	++++	0	++++	0	..	++++	+++++	0
Noguchi antigen	++++	0	++++	0	..	+++++	+++++	0
Spinal fluid—Cholesterin antigen	..	..	..	0	++++	..	+++++	0
Spinal fluid—Noguchi antigen	..	..	..	0	++++	..	++++	0
Trigeminal sensation	0	—	0	Normal	0	—	0	—

tooth pulp. In three cases the pulp was not exposed, but it was so closely approached that a definite pink color was observed through the dentine. In the usual method of dental therapy this situation would be treated as an actual exposure. Controls were unnecessary; the sensation of pain in a tooth is almost a universal personal experience. However, five patients volunteered as controls; in each, the serologic studies were negative and there was no evidence of syphilitic infection or metabolic disturbance. Dental sensation was normal in every case.

FINDINGS

Table 1 contains a summary of the symptoms and findings in nineteen cases of tabes dorsalis. The plus sign indicates the presence of the symptom in question. Table 2 summarizes eight cases of general

paralysis. In both tables under the heading of trigeminal sensation, a cipher represents absence, a minus sign decrease and a plus sign increase of dental sensation.

Exposure of the pulp, with two exceptions, revealed apparently healthy tissue, that is, a pink, freely bleeding, normal pulp with no macroscopic evidence of disease. In two cases, the pulp had degenerated to a nonbleeding atrophic thread. The mucous membrane always retained normal reactions to touch, temperature changes and pressure, with the exception of the eighth case in which there was a slight diminution in the sense of touch. It is interesting to note that patient 9

Nineteen Cases of Tabes Dorsalis

9	10	11	12	13	14	15	16	17	18	19
W	W	B	W	W	W	W	W	W	W	B
53	65	45	43	59	54	45	55	52	44	54
..	..	24	16	..	..	14	..	..	..	28
+	+	+	+	+	+	+	+	+	+	+
..	..	+	+	..	..	+	..	+	+	+
±	..	+	+	..	..	..	..	+	+	..
..	..	..	+	..	+	+	..	+	..	+
..	..	..	..	+	..	+	..	+	+	..
..	..	..	+	..	..	..	+	+	..	+
..	..	+	..	..	..	..	..	+	+	+
..	..	..	..	..	..	..	+	..	..	..
..	..	..	+	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	+	..	..
..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..
.	..	..	..	..	..	..	..	..	+	..
..	+	+	+	..	+	+	+	..	..	+
..	..	..	..	..	..	+	..	..	..	..
+	+	+	+	+	+	+	..	+	+	+
..	+	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	+	..	..
..	5554322100	4554332100	..	..	..	3333221000	4555521000	1122200000	..	..
+++	++++	++++	++++	++++	++++	++++	++++	0	++++	..
0	++++	++++	++++	++++	++++	++++	++++	0	++++	..
0	..	++++	0	0	..	++++	++++	0	..	..
0	..	++++	0	0	..	++++	++++	0	..	..
—	0	?	0	0	0	0	0	0	—	+

in table 2, whose case was not considered one of general paralysis, had decreased dental sensation.

The five untabulated cases, which were tested only by the faradic current, showed markedly decreased sensation in some teeth, and total loss in others. In the tabulated cases the faradic test paralleled the results of the actual exposures of the pulps.

From the findings tabulated, it may be observed that these cases show varying degrees of anesthesia of the sensory branches of the trigeminal nerve, ranging from partial to complete loss of pain, temperature, and pressure sensations. There was but one exception, the fourth case of tabes dorsalis, which presented normal sensation of the pulp. In the eleventh case, the mentality of the patient prevented an accurate study. While at present we are at a loss to account for the

normal reaction of the pulp in the fourth case, it should be noted that the serologic studies gave negative results and the diagnosis was based on the clinical signs and symptoms alone.

A surprising finding was the apparently normal sensation in the pericementum of these patients. In no case did we find any sign of affection of the pericemental branches of the central nerve fiber. This was unexpected in view of the fact that the nerve to the pericementum arises from the dental fiber just before the latter enters the root canal. Our observations showed that sensation in the branch supplying the pulp only was affected. Further, in no case in our series did we see spontaneous exfoliation of any teeth, such as has been reported by

TABLE 2.—*Symptoms and Findings in Eight Cases of General Paralysis*

					Blood		Spinal Fluid				
Case	Color	Sex	Age	Trigeminal Sensation	Wassermann Cholesterin	Noguchi	Wassermann Cholesterin	Noguchi	Colloidal Gold	Globulin	Cells
1	B	M	31	—	++++	++++	++++	++++	5555554431	Trace	54
2	W	M	35	0	++++	++++	++++	++++	555543100	Trace	8
3	W	M	35	+	++++	++++	++++	++++	5555554432	Trace	4
4	B	M	42	Normal	++++	++++	++++	++++	5555442100	Trace	44
5	W	M	45	0	++++	++++	++++	++++	5555221000	Trace	3
6	W	M	38	—	Negative	Negative	++++	++++	5555421000	Faint tr.	6
7	B	M	..	+	Negative	Negative	++++	++++	2233221000	Faint tr.	63
8	B	M	..	0	++++	++++	++++	++++	5555544321	0	0
9	B	M	25	—	++++	++++	++++	++++	1234210000	..	..

various observers. In two cases of tabes not included in this group one of the authors has observed such exfoliation of the maxillary molars.

The majority of these patients had received various form of antisyphilitic treatment. We are unable, however, to find any reference in the literature concerning the effect of such medication on the tooth pulp or the trigeminal nerve. Up to the present, we have observed no effect clinically in patients so treated.

SUMMARY

In a study of dental sensation in syphilis of the central nervous system in a series of thirty-four cases we have found, with two exceptions, varying degrees of anesthesia of the dental pulp without other loss of trigeminal sensation. We suggest that these changes may be due to a specificity of action on the dental pulp tissues by the metabolites of syphilitic infection.

Abstracts from Current Literature

NOTES ON COUÉ'S METHODS OF SELF MASTERY. KARL ABRAHAM, Internat. J. Psycho-Anal. **7**:190 (April) 1926.

This is a posthumous paper by Dr. Karl Abraham of Berlin, who died, Dec. 25, 1925, in his forty-eighth year. Although Abraham was not widely known outside of psychanalytic circles, he was esteemed in the highest and was greatly beloved by his immediate colleagues; at the time of his death he was serving as president of the International Psycho-Analytic Association, having been unanimously reelected, in 1925, at the Ninth Congress of the Association. Dr. Abraham first worked under Professor Liepmann at the Daldorf Asylum (1901-1904), where he made two contributions to Liepmann's special field, aphasia and apraxia, and later became assistant at the Burghölzli Asylum under Bleuler (1904-1907). Abraham had been intimately associated with Freud from 1907 to the time of his untimely death. A psychiatrist of exceptional training and skill, a gentleman of rare charm and geniality, a thinker and writer of refreshing clearness and conciseness, a worker of unbounded energy and hopefulness, Abraham richly deserved the tribute paid him by Freud: "He would have been a model leader in the pursuit of truth, led astray neither by the praise and blame of the many, nor by the tempting illusion of his own fancies."

Abraham states that he does not wish to imply any theory about the actual efficacy of the method but is concerned with the manifest and latent tendencies inherent in it. The main objections to the Coué method advanced by academic medicine consisted in arguments as to the impossibility of healing organic disease by self-mastery and in assertions that his "group-therapy" took no account of the individual as a case and that his technic, a formula spoken in a special way and repeated a definite number of times, was ridiculous and meaningless.

Psychanalysts will not make the mistake of enthusiastic support or unreserved condemnation, notwithstanding the fact that their work with neurotic patients, who undoubtedly constituted the greater part of Coué's clientele, gives them the firm impression that nervous conditions are extremely difficult to cure. We know that the formula "Every day in every way" the patient will "get better and better" reinforces the process of repression at work in the patient. However, psychanalysts have no particular reason to congratulate the chief medical critics of Coué's system, for their own work has led them to adopt views to which academic medicine continues hostile; namely, the belief that the unconscious mind exercises a great influence on the origin, course and cure of organic disease.

However, as analysts we are more concerned with the dynamics of Coué's group method and his apparently silly formula. We must concede that in the group collected about him, Coué is the leader, and thanks to the knowledge that Freud has given us on the subject of group psychology (Freud, S.: Group Psychology and the Analysis of the Ego, 1921), we may be able to explain how the Coué method is able to affect an indefinite number of people. Psychanalytic investigations, for example that of Ferenczi in regard to the affective attachment of the hypnotized person to the hypnotist, also throws light on the factors operative in Coué's technic. Freud pointed out that in any group the relations between the leader and his followers are similar to those existing in the group of two, the hypnotist and the patient, and that the elements at work in the larger groups were an expression of the father attachment and rivalry situation, the Oedipus complex. In his study of group phenomena, Freud postulated an ego-ideal which throws much light on the reactions of the "followers."

Suggestibility, according to Freud, is a manifestation of one person's libidinal attachment to another who represents to him in his unconscious either

his father or mother. Because of such an attachment, each member of the group follows the leader and imputes to him the qualities and aims of his own ego-ideal. All members of a group harbor a more or less common super-ego and reciprocally identify themselves, the one with the other. Each member of the group thus feels the strength of the whole group with which he identifies himself, and through the group adherence regales himself in the expression of his self overrated powers in the form of fantasies of omnipotence. (In America we find innumerable organizations in which the impotent and undistinguished are willing to pay liberally for the unconscious desire to be a "king [omnipotent] for a day," and these organizations must provide their adherents with "regalia" ranging from the exotic red fez with its golden scepter to the white hood of the benighted knight of the "exalted" order.)

Within each group the fiction is maintained that the leader loves each individual equally; he is an impartially good father. In the Coué group, this is particularly so; each adherent, no matter who he is or from what he suffers, receives the same, invariable formula. Coué gives each one as much — or, if one prefers it, as little—as the next. But in addition to being a just father, Coué plays the rôle attributed to the father, chief or king by primitive races; he can banish all ills with a formula. But now comes the great point of difference between father or leader Coué and other leaders, such as heads of the church, army or political factions. The latter must maintain their authority. Coué allows each adherent to share his omnipotence — he gives his formula (power) unreservedly to all his children. Actually he allows every one of them to behave as though he were Coué himself. If the patient were conscious of this — that he has become father — and conscious of the libidinal nature of his attachment, he would not be able to enjoy his newly acquired power.

Ernest Jones (The Nature of Auto-Suggestion, *Brit. J. M. Psychol.* **3**:194 [Aug.] 1923) has pointed out that in hypnosis, even though there is no physical contact between the hypnotist and hypnotized, an erotic nature to the phenomenon is easily established. Now in group treatment, in which many are simultaneously receiving suggestion, this libidinal nature of the transference, consciously displeasurable alike to physician and patient, is reduced to a minimum. In the case of Coué's method, each person's ego is raised in his own esteem; his attention is focussed on this increase in power in the ego, which in turn diminishes the attention to the sexual forces lurking behind every neurosis. Coué's system, then, represents a flight from hypnosis, with its more obvious allo-erotic character. We might say that the libidinal interchange between the hypnotist and patient is intensive; between Coué and his group it is extensive. Coué's system is effective because of its simplicity and the peculiar way in which it deals with the Oedipus complex. Moreover, turning the individual into a member of the group entails a lowering of the intellectual or critical level of the person.

It still remains to be explained why such a large number of patients are so ready to give up a thing (illness) which usually appears so important on rational grounds and which also brings with it a fairly obvious pleasure gain. It is distinctly due to the encouragement which the patient receives to regress to an earlier dependency stage and to identify himself (with father) in a way that corresponds to a very youthful situation. The subject develops a narcissistic attitude of his libido toward his ego, and a libidinal attitude of this kind enables primitive ideas, such as the belief in the omnipotence of thoughts, to be revived again. The objection that the child directs its magic methods toward external objects whereas Coué's followers direct their formula to themselves

can be answered. In the case of the latter, the super-ego, which is identified with Coué, assumes a position toward the ego proper, as though it were another person. Moreover, through this identification with Coué, the tension between the super-ego, which makes certain claims on the ego and the ego itself which has to satisfy them, is to some extent removed. Abraham holds firmly to the main point in the views of Ernest Jones that autosuggestion is a process based on a reconciliation between the ego and the super-ego. In Coué's system the superstructure of the mind, the critical faculties, are more or less broken down and the unconscious mental processes, which are more impulsive, get the upper hand.

In the counting system, like the rosary of the Roman Catholic, Coué's formula serves the purpose of giving expression to man's universal sense of guilt and desire for punishment. As is well known, the association between sin, guilt and sickness (sickness a punishment) is deep-rooted. In behaving like an obsessional neurotic (counting compulsion), the patient is able, without knowing it, to exchange his former symptoms for a mild form of obsessional neurosis.

OBERNDORF, New York.

ADVANCED MENINGOCOCCUS MENINGITIS. TREATMENT BY COMBINED VENTRICULAR, CISTERNAL AND LUMBAR PUNCTURES. MAX MINER PEET, J. A. M. A. **86:**1818 (June 12) 1926.

The value of ventricular and cisternal punctures in the treatment of advanced meningococcus meningitis is brought out by the author. The case mortality of epidemic cerebrospinal meningitis, since the introduction of Flexner's serum in 1907, varies from 20 to 25 per cent; this high rate is due to extreme virulence of the organism, to the presence of a different type of organism from that used in preparing the serum and to late recognition of the disease. The lumbar puncture method of serum administration gives results only in early cases, the mortality being high in late cases; serious sequelae often result when the patient survives, these discouraging results often being due to spinal subarachnoid or ventricular block.

Ayer showed that, without spinal block, 20 cc. of serum injected by lumbar puncture does not reach the cisterna during the injection; 30 cc. of india ink injected into the lumbar subarachnoid space barely blackens the base of the brain, while if given by the cisternal route it stains the entire cerebral cortex as well as the basal cisterna. Therefore, Peet recommends serum administration via the cisterna magna in all cases not showing satisfactory progress under lumbar therapy, and he states that some have advocated its routine use in all cases, discarding lumbar therapy. It is in the presence of spinal subarachnoid block that cisternal puncture is imperative. This method was first used in 1919 (Wegeforth, Ayer and Essick), but was too late to save life. Later, Ayer reported the first successful result which required, as did the case reported in this article, also an intraventricular injection of serum. Mitchell and Reilly reported a successful case. Ebaugh had five recoveries in eight advanced cases. A successful case treated by cisternal-lumbar irrigation is referred to by Ayer. Cisternal puncture is potentially dangerous, but its safety in trained hands is indicated by Ayer's 1,985 punctures and Ebaugh's 1,550 cases — performed for various reasons — eleven cases of meningitis being included.

Ventricular puncture was first brought into prominence by Cushing and Sladen and is of great value, being considered by Howell and Cohen superior

to lumbar puncture. Ebaugh suggests the use of alternate cisternal and lumbar punctures. Combined ventricular, cisternal and lumbar puncture have been used by both Peet and Ayer successfully, and Peet reports such a case in detail, the chief points of which follow: In a girl, aged 8, with a typical picture of meningococcus meningitis, lumbar puncture yielded a yellow, very cloudy fluid, under pressure, which contained large flakes of pus; globulin and albumin were present in large amounts, and the fluid contained large numbers of meningococci. The temperature was 101.4 F., the pulse from 90 to 110, and respiration 22. Forty-five cubic centimeters of fluid was withdrawn by lumbar puncture and 30 cc. of serum given. Five hours later 30 cc. of serum was given intramuscularly. The child became a little more rational, but the next day was still irrational. The temperature was 99, pulse 84, and respiration 18. A slight chill was followed by a temperature of 101.4. The fluid was under pressure but not so cloudy on lumbar puncture. Thirty cubic centimeters of serum was given. At 7 p. m., the temperature was 104.4, pulse 112, and respiration 20. Puncture showed yellowish, cloudy fluid under pressure. Thirty cubic centimeters of serum was given. The next day the condition was about the same — the fluid was cloudy with little pressure, and 30 cc. of serum was again given. The temperature was rising slowly, and the patient cried out on slight motion. At 8 p. m., the fluid by lumbar puncture was not under pressure, and it was slightly cloudy with no organisms. Another dose of 30 cc. of serum was given. The next day the child was very drowsy; the temperature was 104.4. Cisternal and lumbar punctures were then done. The lumbar fluid was slightly cloudy and yellow with no pressure or organisms. The cisternal fluid was opal, very cloudy and under marked pressure. There were many organisms in the smear of the cisternal fluid. Fifteen cubic centimeters of serum was given by each route. At 7 p. m., 30 cc. of serum was given by lumbar puncture. The next day a lumbar puncture with injection of 30 cc. of serum was done at 2 p. m. At 5 p. m., a cisternal puncture was done with the same results, and 40 cc. of serum was injected. Lumbar puncture showed the block still persisting, and 20 cc. of serum was given by this route. The next day lumbar puncture was done with the same results; 45 cc. of serum was injected. In the afternoon triple puncture was done indicating a double block — one spinal subarachnoid and the other between the lateral ventricle and the cisterna. Fifteen cubic centimeters of serum was injected into the ventricle, 30 into the cisterna and 15 into the lumbar space. The next day the patient was better. Forty-five cubic centimeters was given by lumbar puncture, and in the evening triple puncture was again done with the same results and procedures. The next day the child was better and the same procedure was resorted to, but with only 20 cc. of serum injected into the cisterna. Next day there was further improvement clinically, and the blocks as indicated by triple puncture had disappeared. Thirty cubic centimeters of serum was put into the ventricle, 20 into the cisterna and 30 into the lumbar space. The next day lumbar puncture was done and 45 cc. of serum given. The following day the child was rational and 45 cc. was again given by lumbar puncture. Cultures and smears gave negative results. The next day another puncture was done, but no serum was given. The patient recovered. A total of 560 cc. of serum had been introduced by eighteen lumbar punctures, 155 cc. by six cisternal punctures and 75 cc. by four ventricular punctures. All injections were made by gravity, Ayer's technic being used. Spinal block was evident after the fourth day and persisted to the tenth day. Ventricular block was present at the sixth and persisted to the ninth day.

CHAMBERS, Syracuse, N. Y.

ON THE ACTION OF COCAINE DURING CATATONIC STUPOR. J. M. SACRISTAN, Arch. de Neurobiol. **5**:166, 1925.

In a study of the effects of injection of small doses of cocaine (from 0.025 to 0.1 Gm.) on thirty women during catatonic stupor of varying intensity and duration, physiologic serum was injected in the first ten women in order to ascertain whether the mere act of injecting would produce an affective reaction, as has been maintained by Mosler. Since no positive results were obtained, this test was discontinued. Careful observations were made on the pulse rate, breathing, vasomotor excitability, perspiration, Aschner's reflex, etc.; the maximum and minimum arterial tension was also measured with the apparatus of Vaquez. The patients belonged for the most part to the peasantry and did not know the object of the tests; their ages ranged from 12 to 46 years. The duration of their residence in the hospital varied from one to fourteen years. Cocaine produced no effect in eight of the thirty patients injected. However, the action on the vegetative nervous system was manifested in all, although in a variable degree. In some cases a dose of 0.025 Gm. failed to produce a reaction, but a second injection of the same dose produced the desired effect. The pulse rate before the injections was highly variable. Injection of cocaine produced tachycardia, thus confirming the observations of Fleck and Bychowski. The respiratory rhythm was increased. Aschner's reflex was variable. The modifications of the arterial tension, especially the maximal tension, were of some interest. Of sixteen patients in whom it could be measured, there was a conspicuous decrease in eight, an increase in four, and no change in four. These variations were not related to the psychic effect of the injections; of the sixteen patients, ten reacted psychically, and of this ten there was a decrease in tension in five, an increase in two, and no change in three. Since, as shown by Erlenmeyer and confirmed by Joel and Fraenkel, the effects of cocaine on the circulatory system of normal subjects are extremely variable, the results observed in catatonic patients are not significant. The coincidence, reported by von Bakody, of bradycardia, hypotension, slowed respiratory rhythm and increase of Aschner's reflex, was never observed. In no case were there signs of sympathetic excitability, such as pupillary dilatation, which is usually obvious, even with very small doses of cocaine. The action of this drug on the vegetative nervous system of the patients was extremely variable.

The psychic effect of the injections was predominantly manifested in crying, eroticism and, in a very small number of the patients, in a decided hostility toward the environment. These reactions were isolated in some cases, mixed in others, and with or without participation of the motor sphere, in some patients without breaking the mutism. It is interesting to note that the euphoric effect of cocaine, well known in normal persons, fails to appear in catatonic patients. Of the thirty women studied, twelve cried soon after the injection. The first manifestation in five was a decidedly erotic effect of varying intensity, which has not been reported in the literature. This reaction is interesting since it confirms the fact, already known, of the opposite action of cocaine in the sexes. The motor reactions after the injections varied from a simple twitching of the facial muscles to the most violent agitation. With regard to speech, there was also variation; some patients uttered monosyllables, while others displayed an uncontrollable logorrhea. In a few cases only was it possible to converse with the patient, and what was learned gave no insight into the mental processes in catatonic stupor.

The author ends with a discussion of Berger's hypothesis on the pathogenesis of catatonic stupor, and presents a case in which this hypothesis could be

applied. The typical symptoms of catatonic stupor had, however, disappeared several days before the injection, and the positive psychic reaction was easily elicited after an injection of 0.1 Gm. of cocaine. Sacristan believes that cocaine has no practical value in this condition, because of the diversity of its effects.

NONIDEZ, New York.

TREATMENT OF TROPHIC AND GANGRENOUS AFFECTIONS OF THE LIMBS BY RESECTION OF THE CERVICO-THORACIC AND LUMBOSACRAL SYMPATHETIC CHAINS. JULES DIAZ, Arch. franco-belges de chir. **28**:875 (Oct.) 1925.

The author has had little success with the periarterial stripping of Leriche in the treatment of trophic and gangrenous conditions of the extremities. He bases his failure to obtain results on the fact that by arterial stripping alone all sympathetic nerve fibers are not sectioned. He believes that, since we do not know positively the course of these fibers, it is better to sever them centrally at their source rather than after they have broken up into branches, many of which must be missed when periarterial stripping alone is practiced. For these reasons he prefers to cut the cervicothoracic sympathetic chain and to remove the stellate ganglion according to the technic described by Jonnesco for trophic disturbances in the upper extremity. In the lower extremity he excises the lumbosacral sympathetic chain from the second to the fifth lumbar ganglia by the transperitoneal route. The technic of lumbar resection is described in detail.

A number of physiologic observations were made following resection of the cervical trunk. Stimulation of the trunk caused no pain, but stimulation of the individual ganglia was painful. On stimulation of the superior cervical ganglion the pain was referred to the back of the head and base of the skull; excitation of the middle cervical ganglion caused pain in the throat, and stimulation of the inferior and first thoracic ganglia was followed by pain in the lung and the midscapular region on the side on which operation was performed. The ocular changes resulting on cervical sympathetic section were those noted by Claude Bernard and Horner: myosis, enophthalmos and narrowing of the palpebral fissure. The pupil is small but reacts to light and in convergence. The instillation of atropine does not cause dilatation. The narrowing of the palpebral fissure — due to loss of tonus of the orbicularis muscle — corrects itself when the eyeball is turned upward, showing that the innervation of the superior rectus muscle is not interfered with. In time the narrowing of the palpebral fissure decreases, but it never disappears. The enophthalmos is apparently produced by paralyses of the muscles of Landstrom and not by disappearance of the retro-orbital fat, for the condition appears too rapidly to be attributed to a loss of tissue. Intra-ocular pressure is remarkably diminished. Sweating is inhibited in the face on the side on which operation was performed and is much lessened in the ipsilateral upper extremity. Fleeting cutaneous hyperesthesia and slight muscular atrophy are noted in the extremity on the side on which operation was performed. These last two phenomena — loss of sweating and mild muscular atrophy — are also noted in the leg following section of the lumbosacral cord. In both upper and lower extremities the pilomotor and vasomotor reflexes are increased for a short period and then disappear. In every case the arterial pressure is raised in the extremity controlled by the obliterated sympathetic chain, curiously enough more so in the forearm and leg than in the upper arm and thigh. Observations on the capillaries with the capillariscope of Müller-Zeiss show that in every

case in which preoperatively a capillary stasis is noted, postoperatively the capillaries are dilated to two or three times their previous size. Twenty-two operations were performed in twenty cases — seventeen lumbar and five cervical ganglion resections. The indications were in twelve instances thrombo-angiitis obliterans, in three Raynaud's disease, and one each trophoneurotic gangrene, causalgia, acrocyanosis following arteriosclerosis, and tabetic perforating ulcer of the plantar surface of the foot. In every case pain was relieved or considerably alleviated. The trophic disturbances were much improved. The results with section of the sympathetic chain in the cervical or lumbar region were infinitely more satisfactory than those obtained with periarterial sympathectomy. Short case histories of the twenty patients are given. Illustrations and charts demonstrating important points are included.

GRANT, Philadelphia.

THE CONCEPTION OF SEXUALITY (III). ALEXANDER F. SHAND, Brit. J. M. Psychol. **5**:189-195 (Dec. 19) 1925.

Rigid definitions should be avoided in psychology, but there must be a clear definition of the problem. Hadfield's definition of sexual is misleading because he uses the term "natural" instead of "biological," and he also agrees with Glover that its end cannot be limited to reproduction, but would describe the end in the more biologic sense — the preservation of the species.

In reviewing the great variety of things which Glover includes in sexual, he feels the reason for their inclusion "appears to be in every case the psychological identity between the impulses or sensation they have or evoke, and others which are called sexual by 'common consent.'" Glover's attention is directed toward the impulses and sensations associated with the organs and erogenic zones which have the common quality of "sexual" or "libidinal" or "sensual."

It is universally accepted that the normal function of the genitals, when excited by appropriate stimuli, is to arouse sexual sensations. These are not the normal functions of the mouth, anus, nipple, etc., and because they do occasionally give rise to sexual sensation it is not justification to regard these organs as essentially sexual. The same applies to curiosity, aggression and submission, many of our emotions and desires; the fact that these things excite sexual sensations in some persons does not mean that they are to be universally regarded as sexual. To regard such things as sexual he must show they are a normal and common part of human nature. The occasional and unquestioned identity of these organs and emotions with sensations of undoubted sexual character does not warrant the conclusions of the freudians that they are genetically a part of the sexual.

Shand agrees with Hadfield that there is a real distinction between sensuous and sensual as the terms are commonly used. Sensuous has the wider application and applies to all sensation and feelings of sense organs. The sensual is one variety of the sensuous and is generally rather intense. It is a pertinent question, then, whether the sensations of erogenic zones are sensual as well as sensuous. He asks two questions: whether an erogenic zone can excite the genitals, and whether the genitals can arouse sexual sensations in erogenic zones. The evidence for the first, under special circumstances, is regarded as conclusive. The second question is "whether erogenic zones in their own nature have the capacity to arouse sensations psychologically identical with those of the genitals and independently of the latter, being excited simultaneously." The freudians, in answering this question affirmatively, have been

led into error by confusing resemblance with identity. In kissing, for example, sensual sensations arise from coexcitement of the genitals. The freudians attribute these sensations to this erogenic zone in its own right, and the evidence for such an assumption is totally lacking.

Regarding infantile sexuality, Shand feels that the very occasional association of genital excitement with breast feeding does not justify the assumption that this marks the beginning of sexual relation of the child to the mother. It would only be justified if such excitement could be verified in all children. His general conclusions are that the genitals alone are essentially sex organs, and it is naturally a part of their function to arouse sexual sensation. A great variety of other things are occasionally sexual in that under conditions of infrequent occurrence, they arouse sexual sensations through exciting the genitals. Perversions are always sexual because a symbol or an erogenic zone is habitually used to excite sexual pleasure.

CONCEPTION OF SEXUALITY (V). J. A. HADFIELD (reply), Brit. J. M. Psychol. **5**:208-211 (Dec. 19) 1925.

Hadfield says that Dr. Glover has misunderstood many of the points given in his paper. He has assumed all along that there are sexual activities in childhood, activities which eventually would lead to reproduction. But all sensuous activities during this period are not sexual — sucking, urination, defecation and other normal biologic activities later get linked up with genital activities and perversions result, and the sexual activities become diverted from their natural end of reproduction. This occurs before puberty. There is no desire to advance any such idea as Glover attributes to Hadfield — namely, that the sexual instinct emerges *de novo* at puberty.

One of the fundamental fallacies of the freudian argument is to regard as inherent modes of reacting which the environment has imposed on the child. In the example of the child showing more shame to matters concerning defecation than to matters concerning eating, Glover contends that the child has an inherent tendency to react with shame to the first and not to the second, and minimizes the conditioning influences of the environment. The important conditioning factors are the attitudes taken by the parents; if curiosity is satisfied naturally the subject matter soon ceases to be a topic of inquiry.

Glover objects to the definition of sexual as those impulses whose natural end is reproduction as "savoring of a worn out teleology." The biologic point of view stresses the end as it is intellectually conceived. The genetic view stresses the origin. Glover, in adhering to the genetic point of view, takes infantile tendencies and calls them sexual because they later develop into tendencies which are admittedly sexual. The earlier experiences are put in terms of the later, which is really a teleologic approach and not genetic.

The symposium has not answered the question as to what the freudian means by sexuality. Hadfield is still in doubt whether they include all activities involving sensuous gratification or only those sought for the gratification alone.

ALLEN, Philadelphia.

THE BONE CHANGES OF LIMBS WHICH HAVE SUFFERED PERIPHERAL ENERVATION. K. F. KOCH, Arch. franco-belges de chir. **28**, (Nov.) 1925.

An attempt is made to answer this question: Is there a difference in the etiology of the bone and joint changes seen in tabes or syringomyelia and of the so-called neuropathic ossifying myositis? The author believes that

the bone and joint changes are not different in etiology, but that they assume various forms because of the different factors at work in their development. The mechanical factor is the most important of these. For example, in the case of patients bedridden as the result of a complete transverse lesion the peripheral changes are entirely neurotrophic in etiology; there are no important bony changes. But in the case of tabetic patients who are up and about, and in whom the mechanical factor of pressure is superimposed on loss of neurotrophic control, all varieties of bone and joint changes may be observed, aberrant calcification in the neighborhood of the joint, destruction of the articular surfaces and secondary new bone formation. This opinion is based on clinical and experimental evidence. The case is cited of a patient who suffered a fracture of both bones of the leg. The leg was put up at once in a plaster cast. Within twenty-four hours the leg had swelled, and the cast had become unendurably tight and had to be removed. At the point of fracture the skin was blistered and cyanotic. The pressure of the hand could not be borne on the injured leg. Healing was slow, the leg was hyposensitive below the level of the fracture to all forms of sensation and when weight was first borne on it an ulcer appeared at the base of the big toe which required six months to heal. Mechanical pressure plus neurotrophic disturbance caused the ulcer.

Animal experimentation was undertaken to investigate these points. At first sciatic nerve sections were performed on dogs. But it was found that these animals ran about on three legs and thus avoided mechanical irritation of the denervated foot. Rabbits were therefore chosen, because, owing to their method of locomotion, weight must be borne on the hind leg whether it is of use in locomotion or not. The sciatic nerve was cut, crushed, or injured by the application of chemicals. Following the production of a nerve lesion typical pictures of trophic ulceration with fistula formation and osteomyelitis were observed. Periosteal exostoses were noted. In cases in which the factor of formation of fistulas and subsequent infection was eliminated, definite clinical and roentgen-ray evidence of arthritis deformans and osteoarthropathies of the tabetic type were found. Following fracture of the leg in which sciatic section had been performed callus formation was much retarded. If nerve suture was carried out some time after section, the neurotrophic changes were influenced for the better at once.

The author believes that he has demonstrated the importance of mechanical irritation superinduced on neurotrophic inhibition as the chief causative agency of the lesions produced. Neurotrophic lesions in the absence of mechanical irritation cause changes in the extremities involved of a much less serious nature. The article is illustrated with roentgenograms demonstrating the pathologic condition.

GRANT, Philadelphia.

CASE OF LEAD POISONING WITH ONSET SIMULATING TRIGEMINAL NEURALGIA. LEE FOSHAY, J. A. M. A. **86**:1688 (May 29) 1926.

The author reports a case of lead poisoning because of its unusual character and the sequence of symptoms. The patient, a man, aged 44, complained of excruciating pain in the right side of the face of three weeks' duration. The onset had been sudden and the pain seemed to him like a hot, jumping toothache in all the teeth on the right side. In the night he noticed intermittent

pains in the right arm from shoulder to elbow. A dentist to whom the patient went extracted a suspicious molar without relief. Temperature and pulse were normal. Physical examination was negative except for two points of tenderness, one just anterior to the right tragus and another over the upper third molar. The upper third of the right humerus, particularly over the musculospiral nerve, was exquisitely tender. There were no neurologic signs. There was no lead line. Roentgenograms of the teeth and the right shoulder were normal. Hemoglobin was 90 per cent; the urine was normal except for a low specific gravity.

The patient said he had had no contact with lead but that he did painting irregularly, the last time being two months before. There was no history of injury, exposure to cold, or infection. He was treated with analgesics for one week without much change in his condition. Examination now revealed slight atrophy of the extensor muscles of the right forearm with preservation of the supinator longus. This suggested lead neuritis, and that diagnosis was made in spite of the negative history. Blood smears revealed stippling and central achromia. Pointed questions revealed that although he had not been painting he had been mixing paints for other men, using both white and red lead oxides almost daily. There was still no lead line.

One month from the onset he had noted occasional abdominal cramps and constipation. Six weeks from the onset examination revealed atrophy of the extensors of the right forearm, slight atrophy of the right triceps, supraspinatus and latissimus dorsi, slight deviation of the protruded tongue to the right with fibrillary twitching, and no lead line. Eight weeks from the onset there was pain in the left arm and forearm with atrophy of the left abductor indicis. Atrophy of the right forearm and hand had increased after twelve weeks, and for the first time the right masseter was seen to be atrophied. There had been no pain for a month. Eleven months from the onset, improvement was noted, and the man had worked comfortably for six months. Fourteen months from the onset he was well.

CHAMBERS, Syracuse, N. Y.

PAINFUL CONDITIONS IN THE LUMBAR, LUMBOSACRAL AND SACRO-ILIAC REGIONS. JOHN M. BERRY, Arch. Surg. **11**:883 (Dec.) 1925.

The character of pain in the lower back varies from a dull, heavy sensation which simply annoys and depresses, to a sharp agonizing spasm which is unendurable without sedatives. The cause of the pain is equally variable. The underlying pathologic condition may be located in tissues distant from the seat of pain; on the other hand, the bony spine itself may be undergoing destruction by disease. Confronted with such a multiplicity of symptoms and causes, diagnosis usually is difficult or uncertain, and consequently treatment is unsatisfactory. In attempting to make a diagnosis, it is necessary to have some plan as a working basis. The author offers a classification of pain in the lower part of the back for purposes of diagnosis.

The bony framework of the body is held together at its various articulations by ligaments, and, through the agency of muscles, motion and change of position are possible. Certain positions make for strength and stability, others predispose to strain. But little muscular effort is required to maintain the former, while the latter rapidly use up muscular strength. As the muscles tire in maintaining a weak position, more and more tension falls on the liga-

ments. These structures, while poor in blood supply, are fairly well furnished with nerves; consequently, when subjected to unusual tension, a painful strain results.

The bony abnormalities about the lumbosacral and sacro-iliac articulations which may cause pain are discussed at length, and the cause for the pain produced by these abnormalities is considered together with the more important clinical signs and objective and subjective symptoms by which an accurate diagnosis as to the true underlying pathologic condition may be reached. The importance of careful roentgenographic study is stressed. A method is suggested whereby it is possible to show the situation and angle of the articular facets between the fifth lumbar vertebra and the sacrum. It is also possible to show the lumbosacral angle and the angle between the lower surface of the fifth lumbar vertebra and the upper surface of the sacrum. These factors have an important bearing on pain in the lower part of the back, and it is of great advantage to be able to determine them in the living subject.

GRANT, Philadelphia.

NUTRITIONAL CHANGES IN EXOPHTHALMIC GOITER. THE EFFECT OF LUGOL'S SOLUTION. CYRUS C. STURGIS and JAMES A. GREENE, Arch. Int. Med. **36**:561 (Oct.) 1925.

It has long been known and emphasized that there is a definite relation between food intake, basal metabolism, and body weight in patients with exophthalmic goiter. The basal metabolic rate is high and there is an increased energy requirement. The authors, basing their observations on this work, believe that in order to maintain body weight in such a patient while resting in bed, the food intake must be from 75 to 100 per cent greater than the basal metabolism. In a series of sixty-five patients with exophthalmic goiter 88.5 per cent had appetites which were classified as ravenous, increased or normal; at the same time these patients gave a history of loss of body weight averaging 26.3 pounds (12 Kg.) over a period of eleven and nine-tenths months. Comparison of the body weight of these patients showed that 80.2 per cent averaged 18.2 per cent below normal.

The authors compare thirty-six patients, who did not have Lugol's solution before operation and whose basal metabolism averaged 39 +, with twenty-eight patients whose basal metabolism was reduced to 21 + by treatment with Lugol's solution. In the first group there was a loss of body weight averaging 5.2 per cent during an average of eleven days after operation. This was alleged to have been due to a combination of the inability of the patient to ingest normal quantities of food, and of the elevated metabolism which may remain high for ten days or more after the operation. However, in the group treated by Lugol's solution, 18 per cent had gained weight by the tenth postoperative day and the weight loss averaged only 2 per cent for the whole group. This was undoubtedly due to the lower metabolism as compared with the untreated group. Lugol's solution should not be given for more than from ten or twelve days prior to operation because with longer treatment the metabolism is liable to increase again; it should, however, be used for some time after operation. It is also essential to keep the patient as quiet as possible in bed for some weeks prior to operation. The type of anesthetic used apparently had no effect on the postoperative loss of weight.

WAGGONER, Philadelphia.

THE RECURRENT LARYNGEAL NERVES IN DOGS — EXPERIMENTAL STUDIES. ALFRED BLALOCK and S. J. CROWE, Arch. Surg. **12**:95 (Jan.) 1926.

The authors performed section of one laryngeal nerve in a series of seventeen dogs. Several nerves were used for anastomosis, and careful observations of the vocal cords and histologic examinations of the sectioned and resutured nerves were made. The nerves employed for suture to the sectioned recurrent laryngeal were: the descending hypoglossal (end to end); the main trunk of the vagus (end to side); the main trunk of the phrenic (end to side); the root of the phrenic which comes from the third cervical nerve (end to end), and the opposite recurrent laryngeal nerve (end to side). The observations on the movements of the cords after anastomosis were made while the animals were under light ether anesthesia. In most cases the response to direct electrical stimulation of the nerve proximal and distal to the anastomosis also was noted. The histologic studies consisted in the main of preparations stained by Bielchowsky, Cajal and Weigert methods.

There was definite evidence of regeneration following the use of each of the nerves listed. The point is emphasized that conclusions drawn from observations of the movements of the cord during anesthesia are not reliable; electrical stimulation of the recurrent on either side of the anastomosis, histologic demonstration of new axis cylinders, regeneration of myelin sheaths and the increased number of neurilemmal nuclei are necessary to prove a return of function in an animal. The descending hypoglossal and the upper root of the phrenic seem to be the nerves of choice. The advantages of the descending hypoglossal are that it is situated near the larynx (operative injuries to the recurrent laryngeal usually occur near the larynx), and that it is a larger nerve than the upper root of the phrenic. The latter nerve has in its favor the fact that it is a respiratory nerve, and hence is better suited to supply impulses for the delicate movements of the vocal cords. Further, the use of the upper root of the phrenic nerve in the dog does not result in paralysis of any part of the diaphragm.

GRANT, Philadelphia.

DYSOSTOSIS CLEIDOCRANIALIS WITH METABOLIC DISTURBANCES. KNUD H. KRABBE, J. Nerv. & Ment. Dis. **61**:18 (Jan.) 1925.

This name was first given by Pierre Marie and Sainton to a strange defect of the bony development in skull and clavicle. The authors report the case of a man, aged 28, whose father, mother and grandmother had been infected by syphilis. He was said to have been backward mentally and showed "psycho-infantile behavior." He was admitted to the hospital because of hallucinations and persecutory ideas, and had torn his clothing in a disturbed mental state. The cranium showed protruding frontal bulging with a deep groove from the glabella to the square fontanel and to the triangular fontanel. The walls of this groove were softer than bone and roentgenograms showed defective ossification from glabella to the triangular fontanel posteriorly. The squamous portion of the temporal bone was small and the nasal bone was not completely ossified. The medial halves only of the clavicles were ossified, the remainder of the bones consisting of cords of connective tissue. There was hypermobility of both shoulders permitting the shoulders to be pressed together in front of the thorax. There was marked coxa vara on both sides. Another interesting, unusual feature of the case was a basal metabolic rate of + 30.

The disease, of which about 100 cases have been described in the literature, must be considered as a heredofamilial endogenous disease. Syphilis, in spite of

the family history, is excluded by the absence of signs of congenital syphilis and a negative Wassermann reaction. Many other defects of development, deformities of thorax, spine and pelvis, as well as congenital luxations of hips, cervical ribs and muscular anomalies have been reported in these other cases. Little study of the condition from an endocrine angle has been made. Only three other cases in the literature have shown coxa vara. The author believes that the condition should be regarded as a generalized anomaly involving the whole organism.

HART, Philadelphia.

THE EFFECT OF THE SYMPATHETIC NERVOUS SYSTEM ON THE PERIPHERAL VASCULAR SYSTEM. W. BLAIR MOSSER and K. P. A. TAYLOR, Arch. Surg. **12**:760 (March) 1926.

Periarterial decortication of the femoral vessel was performed in a number of cats and dogs. As far as could be determined no definite temperature rise in the leg on which operation was performed followed this procedure, the average being less than 0.1 C. These results appear to indicate that, at least in dogs and cats, vasomotor impulses must have an extravascular course. An attempt was then made to determine the effect of the interruption of the vasomotor impulses in the spinal nerves. Because of its extensive distribution the sciatic nerve was selected. Marked hyperthermia in the leg on which operation had been performed followed injection of the sheath of the sciatic nerve with alcohol. It was further noted that alcoholic injection of the sciatic nerve in sufficient strength to cause motor paralysis also causes an average hyperthermia of 3 C. As the motor involvement disappears the hyperthermia is also reduced. When femoral periarterial sympathectomy was followed by injection of the sciatic on the same side with alcohol, the hyperthermia in this foot over a period of thirty-five days was 4.5 C. Almost the same degree of hyperthermia of the leg was reached when femoral periarterial stripping and injection of alcohol into the ipsilateral sciatic was practiced. Further study seemed to show that concentration of the alcohol solution sufficient to cause motor paralysis in the sciatic distribution causes an increased degree of hyperthermia. But unless motor paralysis occurs no temperature change is noted. It is suggested that, owing to the marked effect on the sympathetic system of the injection of alcohol into the sciatic nerve and the transient nature of the paralyses that follow, this procedure might well be substituted for arterial decortication under conditions in which the latter procedure is at present employed.

GRANT, Philadelphia.

INTRANEURONAL CRYSTALS IN CASES OF SENILITY, CHOREA, AND PARALYSIS AGITANS. P. DEL RIO HORTEGA, Arch. de Neurobiol. **5**:129, 1925.

The author used his own silver impregnation methods (formaldehyde-bromide mixture and silver carbonate, formaldehyde-borate and silver carbonate). In a case of Huntington's chorea many cells of the putamen and globus pallidus contained cytoplasmic inclusions of needle-shaped crystals, scattered through the cytoplasm or crowded in the vicinity of the nucleus. These cells appeared normal in shape and structure. In apparently normal cells of some of the bulbar nuclei in paralysis agitans, there were abundant spindle-shaped crystals scattered through the cell body, in some cells forming groups near the nucleus or toward the periphery of the cell in others. These crystals were oriented with their axes parallel to the axes of the dendrites. The third observa-

tion was made in the brain from a case of senile insanity. The crystals occurred in the cells of the cornu ammonis, were very abundant and formed thick bundles in the cell body, chiefly in the region above the nucleus.

The fact that the crystals were localized in the basal nuclei in Huntington's chorea and in the bulbar nuclei in paralysis agitans is highly suggestive of their association with these syndromes. Since there occur in these diseases lesions of another character, visible in both the neurons and in the neuroglia cells, with a more or less active intervention of the microglia, it seems that the regions involved are the seat of phenomena of disintegration which must be taken into account in the explanation of the origin of the intracellular crystals. According to the author, the crystals probably represent exogenous substances impregnating the cytoplasm of the cells. He suggests that a similar impregnation and condensation of dissolved substances may be the origin of the corpora amylacea described by several authors in the neurons and neuroglia.

NONIDEZ, New York.

BISMUTH COMPOUNDS IN ANTISYPHILITIC THERAPY. EDITORIAL, J. A. M. A. **86**:1352 (May 1) 1926.

Bismuth compounds have found a place in the treatment of syphilis in the last five years alongside of organic arsenicals and mercury. Its usefulness is assured and it is highly valuable in cases of arsenic or mercury-fast syphilis, but we need dependable evidence as to the compounds that are most useful and as to the cases in which they should be applied. Cole, Farmer and Muskdjian, in a study sponsored by the Therapeutic Research Committee of the Council on Pharmacy and Chemistry of the American Medical Association, have shown that finely divided metallic suspensions are inadvisable owing to the tendency for them to remain unabsorbed for a long period. There is then a tendency to cumulative action which also holds true of the oleate and salicylate but to a less extent. The potassium bismuth tartrate preparations are much better, but they too are not beyond criticism in this respect.

Intravenous administration of bismuth compounds is strictly contraindicated. Schamberg believes that bismuth is superior to mercury for the treatment of syphilis and that it is similarly but less toxic to the kidneys. There are undeniable limitations to certain types of bismuth preparations, and a conservative attitude is recommended until more definite and conclusive evidence is available.

CHAMBERS, Syracuse, N. Y.

A STUDY OF THE CLINICAL FORMS OF CEREBRAL HEMORRHAGE, WITH SPECIAL REFERENCE TO THOSE OBSERVED IN CATALONIA. B. RODRIGUEZ ARIAS, Arch. de Neurobiol. **4**:227, 1924.

This article is a discussion of the symptoms of cerebral hemorrhage and the classification of the different clinical forms. The study was prompted by the reputed prevalence of this disease in Catalonia, said to cause 33.33 per cent of deaths in certain towns, with percentages of 5, 9.5, 14.5, and 15 in other districts. According to the author, these statistical data are exaggerated, and he believes that 12 per cent is probably more accurate, since the mortality recorded as due to cerebral hemorrhage also includes all forms of apoplexy. In the words of the author, cerebral hemorrhage in Catalonia occurs with great frequency as compared with the rest of Spain, France and other countries; its distribution in zones is far from uniform, since it is more frequent in certain

wine-producing districts. The proportion of lesions due to cerebral hemorrhage and softening of the brain is nearly equal, with a slight preponderance of the former; they do not produce constant or atypical symptoms.

NONIDEZ, New York.

THE NATURE OF THE FUNDAMENTAL DRIVES. EDWARD CHASE TOLMAN, J. Abnorm. Psychol. **20**:349 (Jan.) 1926.

This is an interesting article giving first the criteria for determining the characteristics of a fundamental drive: (1) individuals of a species must all exhibit a recurring tendency toward certain ends; (2) the tendency toward the need must appear in behavior otherwise different; (3) the difference of strength (of drive) explains difference of behavior at different times in different persons. What seems a departure from the title is dividing the drives into those of primary and secondary orders. The primary drives are those correlated to a physiologic need—hunger, sex, fatigue, excretion and sensitive zones. These are spoken of as appetites. The aversions, also of the primary order, are fear and pugnacity. Drives of secondary order, gross behavior characters, are: curiosity, gregariousness, demand for dominance and demands of submission and imitativeness. The drives of the secondary order are measurable and represent responsiveness to early environment and training. Their dependence on the primary truths must also be considered.

HAMILL, Chicago.

GENERALIZED ALOPECIA. GEORGE WILSON and N. W. WINKELMAN, J. A. M. A. **86**:1424 (May 8) 1926.

After reviewing the literature on alopecia, the authors report three cases with one necropsy. All were examples of generalized alopecia. Case 1 showed alopecia one year after complete hysterectomy with the coincidental symptoms of brain tumor. This condition, the authors believe, was due to the tumor (directly over the pituitary gland in the third ventricle) and not to removal of the ovaries, as this usually produces hypertrichosis; the alopecia did not occur until one year after their removal. The second case presented symptoms following emotional stress and in this case too there were symptoms referable to trouble in the pituitary region, though not necessarily a tumor. The authors believe that emotional stress, although this is disputed by some, is capable of producing marked disturbance in a ductless gland and cite several reported cases. The cause of the alopecia in case 3 was unknown. Various glandular extracts were tried in cases 2 and 3 but without results.

CHAMBERS, Syracuse, N. Y.

THE SACROVERTEBRAL ANGLE, ITS MEASUREMENT, AND THE CLINICAL SIGNIFICANCE OF ITS VARIATIONS. WILTON H. ROBINSON and HOMER W. GRIMM, Arch. Surg. **11**:911 (Dec.) 1925.

The sacrovertebral angle is the angle formed between the sacrum and the last lumbar vertebra. As a result of investigations in a number of cadavers and from the careful examination of lateral roentgen-ray views of this region on living subjects, it is found that the sacrovertebral angle ranges from 128 to 160 degrees, the greater number reading from 148 to 155 degrees. The technic of demonstrating this angle on the roentgenogram is given in detail. The

importance of anteroposterior views is stressed, for by this plate relationships are more clearly defined. Clinically it was found that many patients with a sacrovertebral angle below 145 degrees suffered from low back pain. It is suggested that sudden change in the sacrovertebral angle, with traction on the nerves of the sacral or lumbar plexus, causes pain observed under these conditions.

GRANT, Philadelphia.

THE THEORY OF PERSONALITY. J. W. BRIDGES, J. Abnorm. Psychol. **20**:362 (Jan.) 1926.

This is a complex statement of a complex subject. Personality is a psychophysiologic concept with both physical and mental aspects. Its attributes are classified into three species: the cognitive or sensorial and ideational; the affective or emotional, and the conative or expressive. Personality varies with reference to its components and their organization. Disorders of personality may be the result of disorder or faulty balance in any of the three species of characteristics. This is an article that demands more than the casual familiarity with abstraction possessed by the medical man. Doubtless the complexities of personality are all there and can scarcely be exaggerated, still the useful ideas at the base of this theory seem to the reviewer to be unnecessarily abstract.

HAMILL, Chicago.

MENINGOCOCCUS MENINGITIS WITH RECOVERY IN A SEVEN WEEKS OLD INFANT. J. M. STURTEVANT, J. A. M. A. **86**:1436 (May 8) 1926.

Only seven cases of meningococcus meningitis having been found in the literature in infants under 2 months of age, the author reports a case in a girl, aged 7 weeks, who recovered completely without sequelae following specific serum therapy administered via the cisterna magna. The case is reported in some detail with a weight chart and a chart showing the analyses of the spinal fluid. The chief points of interest are the age of the infant, the mild symptoms, complete block of the spinal canal necessitating the use of cisternal injections, survival from a pneumococcus infection coming within sixty days after the initial meningococcus infection, complete recovery from both infections, present condition and progress normal nine months after the onset of the original infection.

CHAMBERS, Syracuse, N. Y.

CHARACTERISTICS OF THE NEUROTICALLY PREDISPOSED. W. S. TAYLOR, J. Abnorm. Psychol. **20**:377 (Jan.) 1926.

This is a synopsis of an article by Dr. A. F. Riggs on the psychoneurotic patient: who is physically well above the average; whose environment contains no typical difficulty, and yet who is inefficient. The psychoneurotic is oversensitive to emotion and sensation. His instinct of self preservation is overactive with consequent prominence of fear and anger; he is overly suggestible and has character faults usually from a lack of training and discipline. He suffers from a "relative unbalance" of instinct. This leads to a dissociation and inefficiency. Being in the nature of an abstract of another article, "The Psychoneuroses: Their Nature and Treatment" (*Am. J. Psychiat.* **80**:94-109, 1923), further abstraction is impossible. The original article must be read by any one wishing the real substance.

HAMILL, Chicago.

THE OCCURENCE OF FITS IN SYRINGOMYELIA. J. P. MARTIN, J. Neurol. & Psychopath. **5**:227 (Nov.) 1924.

Fits have been met with in four cases of syringomyelia out of a total estimated at less than thirty; the fits are tonic fits; they occur during or just before periods of active progression of the disease and are, therefore, of unfavorable prognostic significance; they are associated with symptoms of increased intracranial pressure and are probably due to acute exacerbations of internal hydrocephalus. It would thus appear that in certain cases periods of rapid aggravation of syringomyelia are associated with exacerbations of hydrocephalus.

FAVILL, Chicago.

ERROR OF BASING SERUM DIAGNOSIS OF SYPHILIS ON THE KAHN REACTION ALONE. SIGMUND S. GREENBAUM, J. A. M. A. **86**:1273 (April 24) 1926.

The author presents two tables: (1) of fifty cases showing positive Kolmer and negative Kahn reactions, and (2) of fifty cases yielding negative Kolmer and positive Kahn reactions.

As the title indicates the author's purpose is to indicate the mistake of using the Kahn test alone, and he urges using both the Kolmer and the Kahn tests for the serum diagnosis of syphilis.

CHAMBERS, Syracuse, N. Y.

Society Transactions

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, April 15, 1926

DONALD GREGG, M.D., *President, in the Chair*

CAMILLO GOLGI (1843-1926). DR. HENRY R. VIETS.

Professor Golgi died Jan. 21, 1926, in his eighty-third year. His life was largely spent in Pavia, where he taught histology and pathology for forty-three years, from 1875 to 1918, and where he made most of his observations on the minute architecture of the central nervous system and on malaria. His collected works appeared in 1903. Golgi discovered the silver chromate method for staining nerve cells and added much to our knowledge of the cells of the nervous system by his descriptions of tissue stained in this manner. He also made important contributions to medicine by his studies of the malarial parasite. An extended notice of his life appeared in the ARCHIVES OF NEUROLOGY AND PSYCHIATRY, May, 1926.

RECIPROCAL INNERVATION OF ANTAGONISTIC MUSCLES AND THE COORDINATION OF MOVEMENT. DR. JOHN F. FULTON.

Recent discussion of the problem of the coordination of antagonistic muscles renders desirable a brief statement concerning the present status of the question. Our knowledge of the functional activity of antagonistic muscles had its origin in the neurologic experiments of Galen. This author (*De motu musculorum*, Book I, Chapter IV, London, Pynson, 1522) maintained (about 180 A. D.) that an antagonistic muscle remained dormant during the activity of a protagonist. The subsequent history of the question has recently been dealt with at length by Tilney and Pike (ARCH. NEUROL. & PSYCHIAT. **13**:289 [March] 1925), and need not detain us here. It is interesting in passing to realize that Descartes appreciated the importance of reciprocal innervation of the eye muscles, and suggested as a mechanism a peripheral valvular arrangement found only in the first and second Latin editions of the *De Homine* (1662 and 1664). What I shall refer to as the "classic conception" of the functional activity of antagonistic muscles is based largely on an extended series of observations, begun by Sherrington in 1893, and continued down to the present time (*Proc. Roy. Soc. Med.* **52**:556, 1893; **53**:407, 1893; **60**:414, 1896; **62**:183, 1897; **64**:179, 1899; **66**:66, 1900; **76**:160, 1905; **76**:269, 1905; **77**:478, 1906; **79**:337, 1907; **80**:53, 1908; **80**:552, 1908; **80**:565, 1908; **81**:249, 1909).

Sherrington's first experiments were concerned with the reciprocal activity of the flexors and extensors of the knee joint of the cat and monkey (*Proc. Roy. Soc. Med.* **52**:556, 1893; **53**:407, 1893). It was observed that if, during the elicitation of the series of knee reflexes from the quadriceps the opposing flexor muscles were kneaded or massaged, the knee reflexes became diminished in amplitude. If, however, the hamstring nerves supplying the flexors were cut, such manipulations were entirely without effect. Similarly, when the flexors were made to contract by stimulation of appropriate anterior roots (the seventh and eighth subthoracic roots), this sufficed also to inhibit the knee

jerk of the quadriceps. This evidence has recently been extended by Liddell and Sherrington (*Proc. Roy. Soc. Med.* **96**B:212, 1924; **97**B:276, 1925) in their discovery that the stretch reflex of quadriceps is inhibited by traction on the opposing flexors. When the quadriceps muscle of a decerebrate preparation is gradually stretched, the muscle responds by active contractions (postural tonus). Other things being equal, the extent of the response depends on the tension existing at that time in the opposing flexor muscles: if the flexors are completely relaxed, the stretch reflex of the extensors is ample; if, however, the flexors are under tension, the response to the extensors is diminished. In these observations, therefore, we have convincing evidence of the reciprocal activity of this opposing muscle group.

It may be emphasized that the conception of reciprocal innervation does not imply that when one muscle is active, the opposed muscle is completely inhibited; it simply means that increase or diminution of contraction does not proceed simultaneously in opposed muscle groups.

The experiments on the reciprocal behavior of the flexors and extensors of the knee joint led three years later to the discovery of experimental decerebrate rigidity (*Proc. Roy. Soc. Med.* **60**:414, 1897). In the meantime, however, the reciprocal activity of the eye muscles was investigated and it was found that, following section of the third and fourth cranial nerves of a monkey, the external rectus muscle, which alone remained innervated (sixth nerve), could be contracted or relaxed at will, thus demonstrating the power of inhibition of this muscle during voluntary activity (*J. Physiol.* **17**:27, 1894). It was found also that inhibition could be produced by stimulation of the appropriate region of the cortex or of the internal capsule. This experiment has been called into question on the ground that relaxation is not observed clinically in patients suffering from combined oculomotor and trochlear paralysis. It is clear, however, that evidence drawn from clinical material, in which lesions almost inevitably develop gradually, and in which, therefore, atrophy from disuse plays an important rôle, is scarcely to be compared with positive results obtained under the ideal conditions of animal experimentation.

One may mention in this connection the convincing experiments of de Kleijn (*Acta oto-laryng.* **8**:195, 1925; *Arch. f. Ophth.* **107**:480, 1922), who isolated the internal and external rectus muscles (by removing the globe) of the rabbit and elicited nystagmus by irrigation of the labyrinth. When an external nystagmus was produced, contraction of the external rectus muscle was accompanied pari passu by relaxation of the internal rectus, showing that spontaneous inhibition of the internal rectus had occurred as a result of contraction of the antagonist. Since these muscles were completely isolated and attached to independent levers, the result cannot be attributed to passive stretch of the antagonist.

Finally, there is the evidence for reciprocal innervation drawn from experiments on cortical stimulation. It was pointed out by Sherrington (*Quart. J. Exper. Physiol.* **6**:251, 1913), and by Graham-Brown and Sherrington (*Proc. Roy. Soc. Med.* **85**:250, 1911; *J. Physiol.* **43**:209, 1911) that reciprocal activity is frequently observed when certain regions of the motor area are stimulated, but that also, especially with intense stimulation, simultaneous spasm of antagonistic muscles not infrequently occurs. One would indeed anticipate this from the familiar phenomena observed in jacksonian attacks, and it is also not surprising in view of the fact that, by voluntary effort, antagonistic muscles can readily be thrown into simultaneous contraction. One must also remember that reciprocal innervation is invariably the rule in spinal animals: appropriate

ipsilateral stimulation of any nerve gives rise unfailingly to contraction of the flexors and relaxation of the extensors. That the more highly integrated voluntary activities should, under some circumstances, differ from the simple reflexes of the spinal cord is scarcely a matter for surprise—a point early emphasized in Sherrington's investigations.

From the experimental standpoint it cannot be too strongly emphasized that the only adequate way of estimating activity in a muscle is by directly measuring the tension that it develops at any given instant. Electrical responses are wholly useless unless one has proof of synchronization of response of individual elements (Compare Golla and Hettwer: *Brain* **47**:57 [Feb.] 1924). Thus, when a muscle is being inhibited, it not infrequently gives rise to far larger electrical responses than were observable during the height of the reflex contraction (Fulton and Liddell: *Proc. Roy. Soc. Med.* **98**:214, 1925. Estimation of tension by means of tambours applied to the external surface are also inadequate, since any deformation of the shape of the muscle, whether it is due to increase of activity, diminution of activity or mere passive movement, is likely to give the same result, as Marey early emphasized (La méthode graphique, Paris, 1885). On this account, the adherents of the classic conception of reciprocal innervation find altogether inadequate the evidence recently put forward against it (Tilney and Pike: ARCH. NEUROL. & PSYCHIAT. **13**:289 [March] 1925.

DISCUSSION

DR. STANLEY COBB: I have been especially interested in this subject for several years. There is nothing that I can add to Dr. Fulton's exposition. We must remember that Sherrington's observations were observations, not theory. All of us who have repeated his experiments have seen the phenomena of reciprocal innervation. That simultaneous contraction of antagonists occurs under certain conditions, as recently brought out by Tilney, can in no way lessen the importance of Sherrington's experimental data. We must harmonize the observations into a theory including both (as I said in discussing Dr. Tilney's paper at the American Neurological Association meeting in 1923). Dr. Fulton has done this in a very adequate and satisfactory manner, giving references to Sherrington's papers which show that Sherrington knew that reciprocal innervation did not regularly occur at the most highly integrated levels.

DR. HENRY R. VIETS: Dr. Fulton's contribution from the physiologic laboratory is an important one. The principle of reciprocal innervation is fundamental. As time goes on, we shall classify it with the researches on the anterior and posterior nerve roots by Ball and Waller's work on nerve degeneration. It does not seem possible to overthrow, although attempts have been made to do so, the careful observations made by Sherrington and his co-workers in the last sixteen years. We may have to modify the doctrine of reciprocal innervation as time goes on, but I believe with Dr. Fulton and Dr. Cobb that this fundamental principle will not be overthrown as the result of future research.

CONSTITUTIONAL PSYCHOLOGIC FACTORS IN "FUNCTIONAL PSYCHOSES." 1. MANIC-DEPRESSIVE INSANITY. DR. HELGE LUNDHOLM.

I have attempted to make a comparative application of two new aspects of the manic-depressive psychoses on clinical facts. One is the view of MacDougall, expressed recently in an article in the *British Journal of*

Medical Psychology, according to which the manic and the depressed phase of the disorder should be due, the former to an overbalance of the instinct of self-assertion, the latter to an overbalance of the instinct of self-submission; the other is a view which I devised tentatively.

My theory is based on the acceptance of the cycloid and schizoid make-up as constitutional factors, in accordance with the suggestion of Kretschmer. By cycloid make-up is meant, however, only a disposition to develop moodiness; by schizoid, a disposition to split in the psychiatric sense of the word. A second assumption is the one of innate tendencies to develop altrocentric and egocentric personality traits. These tendencies, which roughly cover the extrovert and the introvert make-up, are provisionally considered as independent of the cycloid and the schizoid trait, in opposition to the view of Kretschmer. The altrocentric traits are the extrospective, the extro-active and the sympathetic; the egocentric traits are the introspective, the seclusive and the egotistic. Of the traits, on practical and theoretical grounds, sympathy and egotism are assumed to be the most fundamental; compared with them, the others are superficial.

In addition to the cycloid and the schizoid make-up and the altrocentric and egocentric tendencies, man has other innate dispositions, such as the instincts. In the course of life all these dispositions act in a way either to support or to inhibit one another. Speculating on the influence of the altrocentric and egocentric tendencies on the instincts, which are crucial in our discussion, we may acknowledge that strong altrocentric tendencies might favor the development of both the self-assertive and the self-submissive instinct, depending on conditions, while strong egocentric tendencies might well favor the development of self-assertion but inhibit entirely the development of self-submission.

Accepting this as true and accepting also MacDougall's theory as true, we would expect to find in the manic patient—the self-assertive—altrocentric or egocentric traits, or both, while in the depressed patient—the self-submissive—we would expect altrocentric traits, but under no conditions egocentric. The application of the six personality traits, given above on the two phases of manic-depressive disorder, reveals to us that the manic patient is both egotistic and sympathetic, while the depressed patient manifests few if any signs of sympathy, showing on the other hand, particularly in cases of agitated depression, obvious marks of egotism. Thus, we may conclude that the depressed phase of the disorder cannot be adequately explained as due to an overbalance of the instinct of self-submission.

We suggest the following theory to take the place of that of MacDougall: The manic-depressive patient is innately furnished with both the altrocentric and the egocentric tendencies, the latter, however, being stronger than the former. During the prepsychotic period when, according to observations, he is generally of the sympathetic type, the egocentric tendencies are inhibited by social or moral agents; when fatigue or physical disease sets in, these inhibitions break down and allow the egocentric tendencies to dominate. The phase in which the patient enters into the disorder is not dependent on the egocentric tendency, but must be considered as ultimately determined by the mysterious *x* of his cycloid make-up. Thus, it is the combination of the cycloid make-up with strong egocentric tendencies that predisposes to the development of manic-depressive psychoses. Strong altrocentric tendency in a cycloid does not lead to the psychosis, even under very distressing physical suffering.

The altrocentric and egocentric tendencies should be thought of as an agent distributing conative energy into different instinctive channels. While

the instincts have specialized biologic purposes, the altrocentric and egocentric tendencies have only general purposes in two directions, the altrocentric in the direction of furthering the race, the egocentric in the direction of furthering the individual. As such, each one might favor or disfavor a number of different instincts. This, also, is what we see in extreme form in the two phases of manic-depressive disorder. In the manic patient, we find a favoring not only of the self-assertive instinct and the pugnacity instinct by the egocentric tendency, but also of the curiosity instinct by the altrocentric tendency and of the gregarious and sex instinct by perhaps both the altrocentric and the egocentric tendencies. In the same way, we find in the depressed patient a disfavoring of the curiosity instinct due to absence of the altrocentric tendency, and a favoring of the self-assertive and the pugnacity instinct—this particularly in the agitated depression — by the strong egocentric tendency.

The necessity to consider the altrocentric and egocentric tendencies innately, independent of the cycloid and schizoid constitutional factor, is obvious since we have seen that a strong egocentric tendency is one of the psychologic determinants of the manic-depressive psychoses.

DISCUSSION

DR. WILLIAM MACDOUGALL: Dr. Lundholm has raised so many interesting points and has covered so large a field of problems that it is difficult to attempt to criticize. I am glad to find that, from the standpoint of his clinical experience, he has consented to take my hypothesis seriously and apply to it the test of clinical observation. It was in order to stimulate clinical workers that I ventured to put forth that hypothesis; so I find that it is already justified and I need not wish to take it back. Of course, it was impossible for Dr. Lundholm to state the whole case for my theory. He gave a fair selection of extracts in the course of his exposition. I would like to add that according to my view the strength of the theory is greatly added to when the theory of dementia praecox, which I put forward later in my recent volume as a complementary theory, is taken in conjunction with it. The fact that the theories fit together means, I think, that they are reciprocally supported. Of course, I do not mean to suggest that the theory was in any sense adequate in all cases. There must be a great variety of cases. I merely suggested that it interprets a nuclear phenomenon in all cases of this type. Dr. Lundholm's principal clinical objection to the theory of manic-depressive psychosis which I have suggested was, I take it, drawn from the observation of agitated melancholia; but he did not mention what seems to me the essential point in my suggestion as regards agitated melancholia; namely, that the agitation is largely the expression of fear. That seems to be borne out by my own experience in such cases, and I find in the literature strong support for this view. If that is true, fear complicated the attitude of shrinking submissiveness in the agitated melancholia. Dr. Lundholm finds another objection in the fact that melancholic patients are not always purely passive and inert. But if the theory is true, it does not follow that we should expect no urge, no drive toward a goal in these people. The submissive impulse has a certain urgency; it drives for its natural goal, and it is the manifestation of this urgency that Dr. Lundholm interprets as self-assertion in these patients. In that way, I would try to meet the main objections that he raises. That is, perhaps, as much as I should say in my own defense.

I should like to make a slight criticism of Dr. Lundholm's scheme. I am inclined to criticize the term "egotistic." It seems to me utterly ambiguous

and misleading. I do not see that egotism and altruism are mutually exclusive. I think a man can be egotistic and at the same time altruistic. Dr. Lundholm suggests that egotism (which is something ambiguous, undefined, something that should be stated very carefully) is the very essence of introversion. In this he follows Jung, who describes introversion in some of his writings as an extreme degree of egocentricity. That does not seem to me an acceptable view. The extrovert may be and often is very egotistic; therefore, egotism cannot be the very essence of introversion. That would be my main criticism of the scheme.

Regular Meeting, May 20, 1926

DONALD GREGG, M.D., *President, in the Chair*

SCIATICA. DR. M. N. SMITH-PETERSEN.

This paper offers evidence to support the contention that sciatic neuralgia involving the first, second and occasionally the third sacral nerves is caused by lesions involving the sacro-iliac joints. The evidence offered may be summarized as follows: 1. The condition is comparable to pain of the same type involving other joints (brachial neuritis, referred pain from hip joint disease). 2. The innervation of the sacro-iliac joint from the first, second and third sacral nerves will logically account for the distribution of so-called sciatic pain. 3. The mechanics of the joint are such that it is susceptible to slight traumas. 4. Proved tuberculosis of this joint gives rise to symptoms parallel with those produced by trauma of the same joint. 5. Microscopic examination of joint cartilage removed by operations shows definite changes consistent with the traumatic lesion. 6. Roentgen-ray observations, when present, are also consistent with a condition of sprain of this joint. 7. Operative arthrodesis of this joint and of this joint alone relieves the subjective symptoms of so-called sciatica permanently. 8. "Sciatica" may be produced by operation on this joint, if faulty technic is employed.

These arguments correspond closely to the tenets of Koch's law, as applied to the pathogenicity of bacteria, and represent fair evidence of the pathogenicity of the sacro-iliac joint.

DISCUSSION

DR. E. W. TAYLOR: Do you include all cases of sciatica?

DR. SMITH-PETERSEN: I stated in my introductory paragraph that this paper deals with so-called essential or idiopathic sciatica; that is, cases in which there is no demonstrable lesion. Of course, there are cases in which we find a pelvic tumor, or demonstrable pathologic conditions in relation to the sciatic nerve, which will account for the "sciatica." But in so-called essential or idiopathic sciatica I feel that the sacro-iliac joint is the etiologic factor.

DR. J. B. AYER: Dr. Smith-Peterson referred to a patient I had seen. Because of the shortness of time he did not touch on one of the important aspects of this case, namely, a markedly incontinent bladder, associated with severe sciatic pain. Another consultant was strongly of the belief that the patient suffered from spina bifida, which diagnosis, as also that of cauda equina tumor, could not be substantiated on thorough investigation. It was thought, also, that she might have tuberculosis. Following the operation the patient became nearly free from pain, and coincidently perhaps the most important

improvement, so far as she was concerned, was with reference to the bladder which greatly increased in tone so that a residual of from 16 to 20 ounces was brought down to 1 or ½ ounce. This association of bladder incontinence with sciatic pain in sacro-iliac disease is extremely interesting. Another case which I saw had a rather similar picture, but I have not the final report yet. I wonder if Dr. Smith-Petersen has covered the whole range of idiopathic sciatica. I have a feeling that all cases are not due to sacro-iliac disease, but I am satisfied that this condition does explain a large number, so many in fact, that I believe we should consider sacro-iliac pathologic change as the cause until proved otherwise.

Dr. Smith-Petersen: Dr. Ayer has mentioned certain additional points regarding one of the cases with which he is familiar. Operation was performed in this particular case a year and a half ago. The patient's activities are normal; the residual urine is materially reduced. The residual urine before the operation was approximately 20 ounces; at present it varies from ½ ounce to 4 ounces. In the group of cases reported four patients had urinary retention, relieved either by conservative nonoperative treatment or by so-called radical operative treatment. Since the innervation of the bladder is derived from the second and third sacral nerves, and the innervation of the sacro-iliac joint is derived from the first, second and third sacral nerves, there is a distinct relationship in the innervation of these two structures which may account for the symptoms occasionally present.

Dr. H. C. Solomon: If the patient has had rest with a cast, is that a satisfactory form of treatment? Or is arthrodesis more satisfactory?

Dr. Smith-Petersen: I absolutely disapprove of a spica in the treatment of sacro-iliac lesions. The plaster spica produces muscle atrophy and stiffening of the spinal joints, as well as of the hip joint. It sometimes gives relief from pain, but this relief is, as a rule, temporary, the pain recurring on removal of the spica. A spica never overcomes a sacro-iliac relaxation. Personally, I never use that method of treatment; it is illogical.

Comparative Anatomy and Neuropathology. Dr. B. Brouwer (Amsterdam).

My intention is to lay stress on the opinion that an exact knowledge of the relations in lower animals is valuable for the morphology and physiology of the human nervous system. I shall begin with the cerebellum. In the older literature, the human cerebellum was divided into a middle part, called the vermis, with flocculus, and the lateral parts, known as the hemispheres. Elliott Smith, Bradley and particularly Bolk divided the cerebellum differently. In studying several classes of mammals, they preferred a transverse division, while the former was sagittal. After these publications, Edinger, however, brought again the sagittal division to the foreground. He distinguished the paleocerebellum, which is composed of the vermis, the flocculus and the paraflocculus, from the neocerebellum, consisting of the hemispheres. He did not limit himself to the mammal group, but studied all classes of vertebrates. In fishes and amphibians, reptiles and birds, the paleocerebellum only is found. In the lowest groups of mammals the neocerebellum appears. There it is very small but it grows bigger in higher mammals, being largest in man.

Such were the different views held when I got the opportunity of forming a personal opinion regarding this problem. I saw the brain of a man who during life had never shown any cerebellar symptoms. He died suddenly, and at the postmortem examination I found that the left side of the cerebellum was totally atrophied. The brain stem and the cerebellum were examined in a complete series of frontal sections. The atrophy of the cortex cerebelli was

limited to the left hemisphere, the vermis, flocculus and paraflocculus remaining normal. This atrophy was exactly limited to the neocerebellum of Edinger. Afterward I saw other brains of this type. They belong to the group of neocerebellar atrophies of H. Vogt. Not infrequently pathologic processes followed the newer or younger parts of the central nervous system. The idea has forced itself on me that these newer parts are less resistant against noxious agents.

About the same time, the ontogenetic studies of van Valkenburg, made at Amsterdam, showed that the growth of the cortex cerebelli in the human fetus differs in the neocerebellum and in the paleocerebellum. The various layers of the cortex begin to ripen in the paleocerebellum; the neocerebellar part comes later. Van Valkenburg's results and mine, as you notice, agree with those of Edinger. You may thus understand how the idea of a paleocerebellum and a neocerebellum appealed to me. Recently Marburg and Winkler have advanced arguments against this conception of Edinger. One of my pupils, Dr. Koster, who studied two cases of neocerebellar hypoplasia in my laboratory, has given full data about different opinions in this matter. I refer to his book.

I used the brains of neocerebellar atrophy to increase our knowledge of other parts of the brain connected with the cerebellum. I shall select as an example the system of the inferior olives. These consist of large groups of cells, which send their fibers to the cortex cerebelli by the tractus olivocerebellaris, which chiefly proceeds to the opposite side. These inferior olives degenerate when the cortex of the cerebellum is destroyed. I found in two cases of pure neocerebellar atrophy that the degeneration did not extend over the whole inferior olives. The system of the inferior olives in men is composed of a principal olive, very large in man, and of two accessory olives, a dorsal and a medioventral. In these cases of neocerebellar atrophy, the accessory olives were spared, together with the oral part of the principal olives. These observations gave me the idea that both these accessory olives must send their fibers to the paleocerebellum, and by far the greatest part of the principal olive to the neocerebellum. Hence it was necessary to divide the inferior olives into an older and a newer part. I was strengthened in this idea through studying brains of monkeys, dogs, cats and rabbits. In these animals, the principal olive is relatively small, and the accessory olives comparatively large. Careful investigations in comparative anatomy by Kooy and by Brunner have shown that the medioventral accessory olive is the oldest part of the olive system, that the dorsal olives develop next, and later on the principal olive. (Diagrams of some of Kooy's results in mammals were shown.) From the diagrams it is plain that the accessory olives are relatively large in lower mammals, while the principal olive gradually grows bigger in the ascending scale. A comparison of Kooy's results and mine shows that they largely agree, and further that the principal olive grows in an oral-caudal direction.

At the present stage of science, we do not know much about the physiologic significance of the inferior olives. Recent experiences point to their having to do with motility. It may be expected that the system of the inferior olives will play a rôle in diseases of the extrapyramidal systems. Clinical and experimental investigations have shown that the function of the neocerebellum differs from that of the paleocerebellum. Hence we may be sure that the physiologic significance of the older part of the inferior olives differs from that of the younger. From these observations, you may get the impression that the combination of pathologic and comparative anatomy benefits both branches of science.

THE ORGANIZATION OF SENSIBILITY. DR. B. BROUWER (Amsterdam).

The organization of sensibility, my second example, is of more direct clinical interest. Important work on this bit of study has been done by Head and his co-workers in England. In their opinion, there are three chief means by which stimuli for sensibility are caught up in the periphery. The first is deep sensibility which originates chiefly in the muscles and in the joints. By this, impulses produced by pressure and by movement are conducted to the central nervous system. The other systems conduct stimuli originating in the skin and in subcutaneous tissue. These systems are the protopathic and the epicritic. The former are responsive to painful cutaneous stimuli and to extremes of heat and cold. The latter serve for light touch, for discrimination of two points and for appreciation of the finer degrees of temperature. In cooperation with one of my pupils, Dr. Schoondermark, I examined at Amsterdam many lesions of the peripheral nerves in men and studied their recovery. We have verified many of the facts described by Head. Our investigations, however, did not convince us that the existence of two distinct pathways for protopathic and epicritic sensibility has yet been proved. But we felt that this work is a great advance in science, especially because autonomic sensibility has been brought to the foreground. In Head's opinion, protopathic sensibility is closely connected with centripetal sympathetic fibers. It is true that this centripetal side of the autonomic nervous system has not been so closely analyzed as was the centrifugal by Langley, but still we know several facts to work with in physiology and the clinical examination. Huber has proved that in the walls of the blood vessels there are many unmedullated sensory fibers. When stimulated by the pinching of blood vessels during an operation under local anesthesia, severe pain is often felt by the patients. Recently, Leriche and Tournay in France have shown that sensory impulses may, indeed, be conducted by sympathetic fibers.

All the sensory stimuli experienced in the periphery of the body are sent to the spinal cord and to the brain. For a better understanding of the matter, we shall limit ourselves to the spinal cord. The same line of thought may be followed concerning the sensibility of Head. Thus the stimuli for touch, pain, temperature and the proprioceptive sensibility reach the intravertebral ganglions and then proceed through the posterior roots. Ranson found that there are many unmedullated fibers in the posterior roots. He believes that these conduct the protopathic sensibility of Head. In the spinal cord, these stimuli proceed chiefly through two separated pathways. One group reaches the gray substance of the same side of the spinal cord, and here the first sensory neuron ends. A new neuron issues in the cell of the posterior horns. It mostly crosses and proceeds upward in the anterolateral part of the spinal cord. The other group divides the gray substance and avoids the posterior column of the same side. It ends in the nuclei of Goll and Burdach, which lie at the upper border of the spinal cord. Here it is that a second sensory neuron begins, crosses the oblongata and ascends to the optic thalamus. The investigations of Petren, Fabritius, Head and van Valkenburg have made us well acquainted with the physiologic significance of these two systems. The sensory pathways in the posterior columns of the spinal cord conduct stimuli of deep sensibility and a part of the tactile impulses. The other system comprises the stimuli for pain, heat, cold and the remaining part of the tactile sensibility. Many investigators considered the sensibility of the posterior columns as a higher form, the so-called gnostic sensibility. The other form serves more for feeling and is more vital in character. These facts and opinions

have led me to make a study of the development of the sensory systems in the scale of evolution. In the lowest classes of vertebrates (in fishes), the system of vital sensibility is present. The posterior columns, however, are small here and conduct only fibers connecting the different levels of the spinal cord. These animals have only this vital sensibility, which we may call the paleotype of sensibility. As soon, however, in the scale of evolution as life on land has become possible, new demands are made on sensibility. Thus the new pathway is formed. This is the system which we call the gnostic sensibility. In lower animals, for example, in reptiles and in birds, this second pathway is still small, but in the ascending scale this pathway grows and is as great as in man. I call this the younger form of sensibility, or neosensibility.

The results of my investigations in comparative anatomy seemed to establish the opinion that the sensibility of the posterior columns is a higher form because it is younger in phylogenetic development. More recent investigations, however, have shown that the paleosensibility does not remain the same during evolution. Just as is so often seen in the central nervous system, the older parts develop further and are more finely organized in higher animals and in man (Ariëns Kappers). The posterior horn of the spinal cord in reptiles and in birds is much more simply built than in man, and the substantia gelatinosa Rolandi, for example, is not present there. Hence, I believe it is not correct at the present stage of science to speak of a higher form of sensibility, which is conducted in the posterior columns, and of a lower form which is conducted in the anterolateral columns. In my opinion, the chief difference between these two forms of sensory pathways is the following: the so-called vital or paleosensibility is closely connected with autonomic functions and, as I have mentioned already, much of it is brought to the central nervous system by unmedullated fibers. At all events, it is associated in the gray substance with sympathetic centers and there causes, among other things, reflex movements in the sympathetic area. The other form of sensibility proceeds through the posterior columns and avoids the gray substance, this field of association with sympathetic centers. It sends collaterals to this part of the spinal cord but does not terminate there. The impulses, sent in the direction of the cortex cerebri, do not originate in the autonomic nervous system and are not associated with it. They should be called nonautonomic.

Hence, we reach the following conception of the organization of sensibility in the central nervous system. The sensory stimuli are spread through the spinal cord and the brain in two separate systems. The former is the vital system, closely connected with the autonomic system. It is composed of some long and many small tracts, complex in build, and enters the cortex of the brain in a diffuse way. The principle of an exact localization is not found here. On the contrary, these stimuli are diffusely spread throughout several parts of the central nervous system. By this system, sensory stimuli are conducted for vital sensibility which on a high level of the brain may cause sensory feelings. The second is a nonautonomic system. It is composed of tracts of simple build and enters the cortex of the brain in a circumscribed area. This organization bears the stamp of an exact localization. In this system, impulses are conducted for gnostic sensory functions which at a high level of the brain may cause sensory observations but no sensory feelings. It is clear that both these forms of sensibility always work together in the cortex cerebri, and that they constantly interact. It is this constant separate cooperation that enables us to form some ideas of the outer world, so far as this is possible by sensory stimuli. The question arises now whether a somewhat similar division into a nonautonomic and a vital part may be found in other

senses; for example, in smell, taste and hearing. The analysis of the finer relations in the brain do not at present permit our following this line of thought, especially as a more exact knowledge of the central autonomic fields is not sufficient. But there is one function of which we are sure that such a sharp division is present; namely, the function of sight. In lower animals, for example, in fishes, by far the greatest part of the optic stimuli proceed to the midbrain, where many autonomic centers lie. Several autonomic reflexes are organized here and cooperate with reflex movements of the striate muscle system. But in higher animals, a large part of these optic fibers avoid the midbrain. A new pathway is made, bringing the optic stimuli to the cortex cerebri, without seeking any connection with the autonomic centers. This nonautonomic pathway is the great radiation from the external geniculate body to the cortex. Thus, in the optic system we see the same grouping of stimuli in two separate pathways just as in the case of sensibility. It cannot be fortuitous that this is so evident in the optic system.

(Demonstration of diagrams and lantern slides.)

NEW YORK NEUROLOGICAL SOCIETY

Regular Meeting, May 4, 1926

I. Abrahamson, M.D., *President, in the Chair*

Tumor in Antrum of Highmore — Pneumococcus Meningitis. Dr. Max Lederer (by invitation).

E. W., aged 52, a housewife, admitted to the service of Dr. Blatteis in the Jewish Hospital, Brooklyn, March 7, 1926, had for fifteen years been under treatment for right-sided trigeminal neuralgia and headache; the blood pressure was subnormal; varicose veins and ulcers were present; she had always been subject to frequent colds, and for three weeks she had suffered with an upper respiratory infection. She had been married for thirty-three years; had had four children and two miscarriages, and had never had any symptoms of diabetes; no sugar was found in the urine at any previous time. She had been found in a stuporous state sitting on the floor near her bed; she was unable to talk, but apparently suffered from some discomfort or pain in the chest. While being lifted into bed she vomited what appeared to be blood-tinged material. An ambulance was called and she was taken to the hospital at once.

Physical examination disclosed the woman to be heavily built, in coma, with hyperpnea, cyanosis and injection of the capillaries of the face. There was an acetone odor to the breath; the eyelids were slightly edematous; the pupils reacted to light and in accommodation; the ears and nose gave negative observations; the tongue was dry and coated; the teeth were in fair condition. The abdominal reflexes were absent; the right knee jerk was more active than the left; the neck was rigid; no other neurologic symptoms were found. The temperature was 101 F.; the pulse rate 80; respiration 15. The urine contained 2.5 per cent sugar, many red blood cells, acetone and diacetic acid. The blood count showed 20,000 leukocytes with 86 per cent polymorphonuclear neutrophils. The blood contained 272 mg. of sugar per hundred cubic centimeters; the carbon dioxide combining power was 40 per cent by volume.

Following insulin and glucose intravenously, the glycosuria disappeared for twenty-four hours and the acetone bodies were greatly reduced in quantity. On the following day lumbar puncture yielded a purulent fluid under increased pressure containing 7,460 cells per cubic centimeter, of which 79 per cent were polymorphonuclear, and a pneumococcus. The blood culture was sterile. The temperature rose and on the third day the patient relapsed into the hyperglycemic state with a blood sugar content of 172 mg. per hundred cubic centimeters, and marked glycosuria; she developed a left lower facial palsy with right-sided hemiplegia. Brudzinski, Babinski, Oppenheim and Gordon signs also appeared on both sides. She died in coma three days after admission.

Postmortem examination was limited to the head. The dura was normal. A milky exudate was distributed along the course of the veins, especially those of the sylvian fissure. In the ventral surface of the pons was a small hemorrhage 0.5 cm. in diameter. Attached to the dura on the right side was a tumor 6 by 5 cm., which extended to the sphenoidal fissure and had eroded the lateral wall of the body of the sphenoid, the lesser wing of the sphenoid and the anterior third of the petrous portion of the temporal bone. It projected into the maxillary antrum. On opening the ethmoidal cells, a large amount of yellow pus escaped. The pituitary gland was about two and a half times its normal size, red, soft and boggy. Microscopically, part of the posterior lobe was the seat of an abscess which encroached on the infundibulum. Examination of the tumor revealed the typical structure of an endothelioma.

The points of interest in this case are: (1) the possible association of the slow growing endothelioma of the dura and the trigeminal neuralgia; (2) the hyperglycemia and glycosuria apparently are consequent to an abscess of the posterior lobe of the hypophysis; (3) the unusual portal of entry of the pneumococcus via the ethmoidal sinus, due to erosion of the lateral wall of the right nares by the tumor.

DISCUSSION

Dr. Irving Sands: The hemiplegia was accounted for, of course, by the hemorrhage on the lateral surface of the pons. The patient was unconscious and we could not elicit any eighth or ninth nerve symptoms. One could see definite flattening of the left side of the face in the lower two-thirds, and a right-sided hemiplegia. At the necropsy I could not find the gasserian ganglion; there was no ganglion whatever. The anterior third of the petrosa was missing. The pus exuding from the ethmoid cells was unquestionably the cause of the pneumococcus meningitis. She received as much as 200 units of insulin without change in the blood sugar content. We feel that the injury to the pituitary must in some way be connected with the glycosuria.

A Psychological Study of the Nature of the Idiot. Dr. L. Pierce Clark.

Idiocy and all states of mental arrest are probably subject to mental analysis as well as psychanalysis. These states are, in the terms of dynamic psychology, egoneuroses of narcissistic origin or pathoneuroses of intra-uterine life or earliest infancy. The cerebral lesion or lesions wound the ego organ (the brain) and in consequence the narcissistic libido is imprisoned in these damaged structures, thus preventing free circulation and upbuilding of the psyche. The clinical picture is one of an almost pure form of ego pathoneurosis of infancy consequent to this damming-up process. Fortunately, in the majority of such cases there is some libido not entirely engulfed within the ego; this, however, is largely of the narcissistic type and to be made useful in retraining and development. We must first give libido to these charges

instead of extracting it by disciplines and commands. Once freed in part by more libido formation, in play and personal living advantages, they may once more be gradually placed toward ego development and finally to objective interests and love so that, later, socialization may be brought about as in normal children. The fault heretofore has been in placing too much stress on mechanical (physiologic) principles and not on the libido as the emotional leverage by which the intellect as such may be quickened and made alive. In part this stress laid on the importance of the emotions is not new; Itard and many a worker in the educational field for this feebleminded class have operated practically with the same general results that we desire to bring about. The main contention is, however, that the accent on using the emotions is not on that point alone but, in addition, should be brought into play in the light of Freud's work in dynamic psychology, and as such should be employed by those skilled in psychanalytic technic and its practice. Finally, not the least advantage of our preliminary study is the influence of reawakened attention which this manner of approach may have on all teaching for many so-called normal children only a little retarded in mental development, in which the ego development is perverted or not properly sublimated into objective interests of normal living.

DISCUSSION

Dr. H. W. Potter (by invitation): I am glad to have heard this paper by Dr. Clark because it is a very valuable sidelight on my work with mental defectives in a large state institution. From my experience, I think I have a few sidelights which might be interesting in relation to many of the things which Dr. Clark has brought out. The first of these is the use of the term "idiocy." Of course there are all kinds of idiots, as one might say there are all kinds of normal persons, and I am under the impression that Dr. Clark was speaking particularly in his paper of idiots of secondary origin, that is, due to meningitis or some other cerebral accident. Whatever the etiology is in these cases, we see this type of narcissistic behavior in many idiots, but we also do not see it in many others. This brings up the question of just what the relation of this type of behavior is to the idiocy, or what the relation of the idiocy is to the narcissistic expression. If you go through the dormitories where there is a large group of idiots you will see a certain number who are practically identical with the cases of dementia praecox in the wards of a state hospital. One begins to wonder if there is such a thing as infantile dementia praecox, because this reaction is so remarkably comparable to that of certain deteriorated types of dementia praecox. What relation the narcissistic fixation has to the development of intelligence should also receive attention.

I would not be surprised if quite a number of persons were thinking that all that Dr. Clark has said may be nice and interesting, but how can it be put to practical use? It can be done and is being done at present in many institutions, and is being carried out on a large scale in the institution from which I come. It is not being done in so individualistic a manner as Dr. Clark describes, but it is being done very effectively.

We have a class of over 250 patients, with three or four periods scattered over the day. The woman in charge of the class is the only one who can carry on the class. She began work about eighteen months ago on a limited scale, taking four or five patients to begin with, and getting them to do some of the simplest things, things which are obviously of considerable use and things in which the patients almost immediately take a definite interest. In

other words, as Dr. Clark would say, she coaxes out the libido of these patients into their environment. There are certain of the higher grade defective girls who can be picked out to assist the instructor in carrying on this work with idiots and low-grade imbeciles. This has been of decided benefit to the patients and to the general management of the dormitories in which they live. The patients have changed from untidy, practically vegetative organisms, to children who are more or less alert to their environment; they are able to keep themselves clean and care materially for themselves. In the second place, the objects which these children make are of practical use in the institution. An interesting feature is that, as far as the test of intelligence is concerned, they have not gained anything at all. In other words, a child starting in the class with an intelligence quotient of 25, despite the fact of his tremendous social and emotional improvement, will remain at the same intelligence level. But that is neither here nor there, because they are much better persons socially, and the institution is much better for their improvement.

DR. PHILIP R. LEHRMAN: My experience with idiots is very limited, except for the occasional emulation of them. Facetiously, we may say that heretofore we have been trying to think idiotically, but Dr. Clark stresses the fact that we should also try to feel idiotically, and perhaps in that way we can get a better understanding of these patients. Certainly it would seem that the approach he is attempting would be encouraging from this standpoint. What he is trying to do is to apply his psychanalytic insight to a fundamental factor, the lack of which causes the idiot to react more idiotically. The idiot usually lacks the object libido side of his development. In that particular he is entirely different from schizophrenic and encephalitic patients who have had object libido in their development, but as a result of their disease process have lost it. In dementia praecox what we are attempting to do is to rescue some part of the object libido that has been lost and bring it forward. To the idiot Dr. Clark wants to add something, and this addition Dr. Clark thinks can be utilized for the better socialization of the idiot. It would seem to me that the approach itself is courageous, and we certainly ought to encourage it. It is an approach that might help the idiot, that might help the institution problem, and might help the teacher in handling the problem much better than he has been able to handle it before.

DR. SMITH ELY JELLIFFE: Dr. Clark is an incurable idealist. I have been called an idealist as much as he, and therefore I am in accord with most of the points of view expressed. I can quite understand why Dr. Clark should go into this situation, surrounded as he has been from his earliest years in psychiatric work by extremely difficult problems. They have not been easy to solve, and I think I can say that he has not been content just to get his meal-ticket; he wants to earn it, and therefore he has dug deeper and deeper into these problems with the hope of some solution. He is not a blind optimist by any means; he has already said that he is not expecting to rejuvenate a whole class that he has roughly delineated as idiots.

I have just been trying to struggle through a book by Ogden called "The Meaning of Meanings," and in reading it have been more and more convinced of the validity of that cynic's definition of what a "normal" person was. He said that a "normal" person is an idiot who is able to conceal his idiocy. In an appendix to this interesting book, Malinowski, reader in ethnology in Cambridge, gives some interesting illustrations. He says: "Once I placed myself in the midst of a group of New Guinea savages and listened to their pow-wow, and as I listened to it, there were certain sounds with which I

had become more or less acquainted after four or five years, and I think I did fairly well, because I could translate the words for them over into the equivalents which I myself know. But if I start on some line of conduct based upon this belief of mine, and relate to my people what was meant by the pow-wow, I find that I get myself into a great many difficulties. In other words, I do not understand the finesse and nuance of their pow-wow." I think in a certain sense Dr. Clark's point of view is similar; that there is an enormous mass of small detail in the idiot pow-wow, and unless we can get down and roll around on the floor with them, and stick our fingers in our noses, we do not know anything at all about their pow-wow. That is the most important thing Dr. Clark is bringing out; the individual must try to mirror himself into the situation going on in the mind of the idiot; and mirroring himself, he may be able to get the meaning of meanings of what they themselves are trying to do. I do not know that he is willing to accept this particular form of description of the process, but that is the way it appeals to me, and that gives it a legitimacy which in my point of view is worth subscribing to. "Every tub stands on its own bottom," every idiot is an individual problem, and as Dr. Potter said, there are idiots and idiots, and then still some more. This individualistic approach may be an illusion, but I think it is turning out to be a profitable illusion. Man lives by his illusions, as Ibsen has so well reminded us in his "Wild Duck," and so from my point of view, whether Dr. Clark wants to call it mental analysis, psychanalysis or analytic psychology is immaterial, except insofar as I agree with him that the psychanalytic mode of approach is valid and useful, and is the latest aid we have for understanding the meaning of meanings.

Dr. Adolph Stern: As I understand it, the idiot that Dr. Clark is considering is one who has become such through a trauma, not the idiopathic idiot. In these cases some injury has been inflicted on the ego mechanism, and in its attempt to adapt itself to the environment it has regressed to a defense mechanism. Clearly there is an hypertrophy of the ego, as Hollos and Ferenczi pointed out in the case of the general paralytic patient, when the person seems to take the injury to the brain as an assault on his ego, necessitating, in order to preserve himself, an hypertrophy of that ego, as much as to say: "Nothing has happened to me; Look at me. I am very capable. I can do this. I am unlimitedly wealthy. I have enormous power." There is an hypertrophy to correspond to the trauma the person has experienced, and it seems to me that the idiot does something similar. The idiot seeks emotionally in a wholly primitive way to get what he wants. You cannot really speak of regression in the case of idiots. There is no regression. The libido is of a primitive sort and has never regressed, because it has never progressed, so that the idiot shows himself in a more or less natural emotional state.

I feel that one cannot speak with any strictness of "psychanalysis" in these persons. It is not psychanalysis except that the approach to the study of the idiot is based on psychanalytic knowledge. The phenomenon of transference, so characteristic in psychanalysis, does not come into play in the case of the idiot. The idiot in treatment simply takes in his teacher or his love-object and then at any moment simply ejects him and withdraws in toto from that love-object. Once the object is introjected, nothing is done with it in the way of development or of adapting himself to the love-object. He takes it in, holds it, and when he cannot use it, throws it out, and then the idiot becomes just as intractable as he was before.

Those who treat the idiots under Dr. Clark's care are persons of the "dull normal" type. For my part, I cannot see how any one but a rather dull normal could spend hours and hours, weeks and weeks, struggling with the disappointments and the primitive, uninteresting material that the idiot presents in the way of treatment. Any one who can do something with an idiot deserves a great deal of gratitude.

DR. JOSEPH SMITH: In this discussion nothing has been said in regard to certain anatomic considerations which we should take into account when dealing with the question of idiocy. One can approach some cases from a purely psychanalytic standpoint, but there are gross brain alterations in idiocy which at once rule out psychanalysis, since we can explain many of the symptoms, such as the low level of intelligence, on anatomic grounds. Secondly, as Dr. Stern has already said, the principles of psychanalysis which we employ in the study of primitive emotions and ideas of narcissistic neuroses cannot be made available to the understanding of idiocy, because the idiot has not progressed to a sufficient extent and then regressed to a primary stage of development, but in his emotions and intelligence has remained at the lowest possible level. Neither in his paper nor in the discussion which followed has there been a clear separation made between idiocy and other defectives of higher intelligence, for we must remember that the highest mental age of the idiot has been placed at two years. Furthermore, a prerequisite to any psychanalytic approach is an adequate intelligence on the part of the patient. We cannot apply psychanalytic technic to the study of the idiot either in the sense of reconstructing the patient, which Dr. Clark himself does not claim, or to get an occasional amelioration of the symptoms.

DR. I. T. BROADWIN: Under well directed supervision the idiot may improve in his actions to a certain degree unless the idiocy is due to a progressive devastating organic process. As long as something is done to help him, and this also applies to all mental defectives, some improvement will follow. The improvement may merely amount to better habits of cleanliness. The more severe the degree of mental defect, the more limited is the degree of so-called improvement. The manner of treatment or supervision is in direct line with modern psychologic trends in pedagogy — direct appeal to the needs of the individual.

Dr. Clark speaks of the psychanalytic approach to the ego of the idiot. This statement must appear paradoxical. I can more readily conceive of the ego of the higher grades of mental defect than of the idiot.

DR. CLARK: Apropos of the ego development, Freud has said that in the first six years of life the ego is sufficiently established and the personality is fully capable of taking on such a degree of enduring patterns that ecclesiastics have based the permanency of impressions in adulthood on what the child learns at or before this period. The ego binding is so far advanced in its conception of reality that it is able to stand alone without panic or undue fear. I have recently put together a manuscript of several hundred pages illustrating the degree of advance in the integration of personality that is made by the child in the first three years of life. The amount of development known at this early age makes it possible for at least a dozen authors to give a fairly consistent picture of this period.

In answer to what Dr. Stern has said, that little or nothing has been done or can be done for these patients, I would say we have already demonstrated that something has been accomplished. How permanent and what will next succeed to what we have already done only time can show. Apparently what

I have merely casually commented on in reference to the use of dull normals as a part of the analytic tutoring has been taken as one of the main tenets of my thesis. So far all my work has been done by very ably trained analytic assistants, but I do not despise the aid of dull normals in the work. We should remember that the dull normal, as designated by Terman, shows an intelligence quotient of 70 to 80 or thereabouts. Many of these are only dull by our limited intelligence-testing. In many living requirements they are often superior to the so-called normals. In other words, their sensibility to human relationships is of a superior sort, as any one who knows them well will attest. In fact, they are often extraordinary persons as regards their emotional relationships. I am proud to count a number of them among my intimate friends. I agree with Dr. Potter that many of these seemingly dull persons have the capacity to understand the behavior of the idiot, which normals have lost or never have had. It is not dissimilar to the fact that schizoids are often able to give us better interpretations of praecox productions than we ourselves can give. It often happens that the mildly neurotic are able also to give us a better understanding of neurotics and psychotics in general than many analysts. Indeed, many if not all analysts have sensitized fixation points in their own development that enable them to understand the modified reactions in their patients much better than so-called normals. And I am pleased to state that I rank myself with the understanding group. I am not so sharply demarcated from the idiot class that I may not sympathetically keep in touch with a wide range of human behavior of which the idiot's is not the least. This work of mine is not without a propagandist import inasmuch as it is hoped that it will aid us throughout the field of the narcissistic neuroses. Work in this field will also teach us to rid ourselves of narcissism or so to master it for the benefit of our patients that we may make more rapid progress in unraveling the mysteries of the narcissistic states in which a certain degree of ego defect or undue narcissistic fixations are interwoven in psychotic reactions. Trained intelligence alone will not do this as the lag in our knowledge of dementia praecox has shown. We must remember that the idiot, like the ape and dog, belongs to our mammalian world, and the two latter types, perhaps, have such good and permanent fixations in their own egoistic patterns that no amount of narcissistic transference will enable us to break them down. So good an authority as Professor Yerkes has said that the ape is as fully able to talk as man, but we are not able to induce him to do so. Aside from idle curiosity, perhaps no one desires to break down the narcissistic imbinding of the ego pattern of the ape or dog, as neither is compelled, nor do they seemingly, care, to live in our type of existence; but not so with the idiot. He is born in our midst and needs to embrace our expanding socialization if he is to live satisfactorily. By mastering our own narcissism we may be able to enter the closed narcissistic system of the idiot rather than, as at present, pounding on it from the outside and following his deeper regressions into the most primitive infantile patterns of behavior reactions. There are regressive features in the idiot. It is only our own narcissism that fails to make it comprehensible to us. I can show the whole range of some of the dementia praecox-like reactions in idiots. The idiot has three years to regress. It is the establishment of the first five years of our existence, according to Freud, which lays the pattern for all neuroses. If that is the case, we have a pattern for over half of them. I have taken occasion to write a lengthy monograph so that other persons may see what I have been laboring at in the developmental period up to three years of age.

FACIAL PARESIS AS A MANIFESTATION OF TUMORS OF THE UPPER HALF OF THE CERVICAL SPINAL CORD. DR. WALTER M. KRAUS and DR. NATHANIEL E. SILVERMAN (by invitation).

The signs and symptoms of tumors of the upper four cervical segments are both varied and numerous, and their diagnosis is often difficult, simulating at times the clinical pictures of hereditary ataxia, combined sclerosis, Pott's disease, pachymeningitis, etc. The variety of involvement of various cranial nerves is striking: choked disk, pupillary inequality, facial sensory disorders, absence of the corneal and pharyngeal reflexes and nystagmus. The finding of facial paresis, however, has been little emphasized. It is referred to by Elsberg in two cases.

The material analyzed consists of ten cases. In seven cases, lower facial paresis was noted; five of these were extramedullary and two intramedullary tumors. In two of these seven cases necropsy was performed; one was found to be extramedullary, the other intramedullary. The facial nucleus and nerves on examination proved to be normal. There was no pathologic change above the foramen magnum which could account for the paresis, and in none of the cases without necropsy was there evidence of disease in the neighborhood of the seventh nucleus or its fibers and nerves. The question of hereditary or acquired nonparalytic asymmetry can be ruled out.

In attempting to arrive at an anatomic basis for this phenomenon, several pathways were considered. The facial musculature is a derivative of the second hyoid arch which has developed from the sphincter colli of fish and amphibia. It extends in man downward over the front of the chest. There is no evidence to show, however, that the platysma is supplied by spinal nerves as well as by the seventh nerve.

The sensory derivatives from the cervical plexus to the lower face, head and neck were considered, and perhaps are affected in the same way that the facial musculature is affected in trigeminal lesions.

Another possibility is a reflex through the gustatory system which descends into the upper cervical region with the fasciculus solitarius. That impulses of taste produce facial movements is well recognized and similar reflex movements, pseudo-affective in type, are known from the records of reactions of decerebrate animals.

These suggestions are offered in order to correlate the clinical interpretations and their relation to anatomic pathways. The fact that not all the cases showed this sign indicates that some specific mechanism is present.

DISCUSSION

DR. KRAUS: The clinical evidence which we have presented seems clearly defined. The explanations which we are able to give of these observations are not satisfactory. The fact that the facial musculature in lower animals is cervical in origin, and that the tumors are located in the upper cervical regions, led us to the idea that an association pathway within the nervous system may exist. However, we have no evidence for this at present.

CONCUSSION OF THE BRAIN. DR. MICHAEL OSNATO and DR. VINCENT GILIBERTI (by invitation).

Early in our observation of postconcussion neuroses we became impressed with the difference in the nature of the reactions from those cases of post-traumatic psychoneuroses in which it had been definitely established that the

head injury, if there was one, had not resulted in actual disturbance of brain tissues, evidenced chiefly by unconsciousness. It also occurred to us that many of the subjective symptoms in the postconcussion cases were like some of those complained of by sufferers from the residuals of epidemic encephalitis. As a result we undertook a complete study of the pathology of cerebral concussion and a comparative statistical study of the subjective symptoms in epidemic encephalitis and concussion.

Adami points out that the cerebral blood vessels rupture easily because they have a slight muscular coat and the brain substance offers little support. Cassasa's explanation of the mechanism of concussion depends on the identification of a "network of fine fibrils connecting the external wall of the blood vessel with the surrounding brain tissue across the perivascular lymph space. Sudden overfilling of the perivascular lymph space with cerebrospinal fluid conceivably could produce a laceration of a vessel by tearing of its wall in the neighborhood of such a fibrillar attachment. Such an increase of cerebrospinal fluid in the perivascular lymph space could be caused by the cerebrospinal fluid from the surface of the brain being driven into it by the pressure exerted by the change of shape of the skull — the result of a blow or fall. This fluid must find its way out of that area through the various sulci of the brain and in connection therewith such fluid as cannot find its way through these channels must find a way into the perivascular lymph spaces in the reverse direction of the normal flow of the cerebrospinal fluid." Cassasa also refers to the experiments of Weed which demonstrate that the perivascular lymph space (Virchow-Robin space) is directly connected with the finer spaces about the cerebral ganglion cells. He now advances the theory that sudden physical distension of these periganglionic spaces by cerebrospinal fluid causes a direct physical change in the ganglion cell which may explain all the phenomena of concussion of the brain. This simple change may occur without minute hemorrhages and explains the completely negative observations of some authors who have performed necropsy in concussion cases.

The late changes resulting from brain trauma are well described by Meyer, and by Tanzi and Lugaro. Briefly, these residuals are small foci of softening or defects of cortex in the tips of the frontal or temporal lobes. Not only the absence of glia margin beneath the pia was found in some areas, but also an increase of the subpial glia in the same brain. The diffuse effects mentioned by Meyer are extensive. One of his cases showed extensive lesions involving many parts of the brain, but particularly degeneration of the "median striae Lancisii after destruction of both olfactory bulbs. The optic chiasm showed unmistakable semidecussation and the indirect scattered lesions caused by the concussion were exceedingly extensive and involved mainly the splenium of the corpus callosum and the long paths — the fillet and the superior cerebellar arm. There was also slight implication of both fifth nerve roots and of the optic nerves." But even in Meyer's series the same difficulty is found as was encountered in studying the cases resulting from war trauma in the series reported by Cushing, Head and others; namely, the injuries to the brain were much more severe than we have reason to believe occur in simple concussion. For that reason the value of Cassasa's series and the case studied by us is difficult to overestimate. Tanzi and Lugaro attribute a purely psychogenic origin to the cases of what they call traumatic neurosis, but in the cases which they classify as "dementia traumatica," they describe the following lesions: "small, old hemorrhagic foci, transformed into cysts or into glial scars, diffuse chronic lesions of the nervous elements, chronic diffuse lesions of the vessels,"

and conclude by saying, "One must admit that following trauma there may be localized gross lesions or very mild diffuse lesions following which a chronic process of gliosis and degeneration of nerve cells takes place."

The conception of traumatic encephalitis as a type of the encephalitides is not new, but this is based on a study of brain injuries which involve also the skull and meninges. The encephalitis which ensues is seldom purely traumatic, because the descriptions refer to "abscesses of greater or lesser extent, with more or less diffuse inflammatory reaction, manifesting itself in the perivascular spaces by the presence of leukocytes and accompanied at the edge of the involved area by the appearance of numerous giant neuroglial cells. Necrotic lesions coexist with hemorrhagic ones producing serious involvement of the axis cylinders." This type of traumatic encephalitis is well described by Foix.

In cerebral concussion there is, notably, the absence of any considerable neuroglia reaction and nothing of a really definite nature is seen in the other cellular elements of the nervous system. Those cases which come immediately to necropsy show mainly uneven staining of cell bodies, eccentric nuclei and a diffuse hemorrhagic and acute thrombotic picture. The disturbed blood vessel is usually in the periphery, the white or gray substance of the deeper parts of the brain are comparatively free. The pia-arachnoid suffers most. Greenacre described the hemorrhages as being almost uniformly punctate, frequently grouped around the periphery of the pons, and connected with small sub-pial extravasations and numerous lacerations. Later, glial proliferation and the various stages of sclerosis of the ganglion cells are seen, together with evidence of degeneration in the axis cylinders, dendrites, etc. Meyer refers to the process as a typical Wallerian degeneration. It must be understood, however, that these secondary degenerative reactions probably occur very rarely indeed. Surely the vast majority of cases of concussion recover with almost complete resolution of the diffuse hemorrhagic process, even granting that this occurs in all cases of severe concussion. Considering the enormous number of persons who have in infancy, childhood or adult life suffered a concussion of the brain we must admit that permanent disabling clinical phenomena following concussion of the brain, with or without fracture of the skull, are not commonly encountered. Even in cases in which gross craniocerebral damage is present the number of cases of traumatic insanity or epilepsy, or of brain tumor which develop following such injuries, is surprisingly small indeed. This applies with even greater force to the pure concussion cases. Nevertheless, when the hemorrhagic process has been so marked and so diffusely present as in the case studied by us (lantern slides), it cannot be otherwise than that certain mental and neurologic disabilities, chiefly the former, may follow, developing apace with the secondary diffuse glial and ganglion cell degenerations. The degree of this diffuse secondary process will, of course, determine the nature and severity of the clinical phenomena, with one very important reservation. Sooner or later, certain influences operate to produce a group of emotional symptoms which it is difficult not to classify as purely psychogenic in origin. Even in epidemic encephalitis or other organic disease of the central nervous system, emotional situations often do add a purely psychogenic coloring to the picture, and cases of cerebral concussion are no exception.

DISCUSSION

DR. LEON H. CORNWALL: Through the courtesy of Dr. Charles B. Cassasa, assistant medical examiner of the city of New York, I have been privileged to examine the brain in a case of concussion. The specimen came from a

young man, aged 30, who was knocked from a motorcycle and rendered immediately unconscious. He was taken in an ambulance to a hospital where it was deemed wise to perform decompression. While on the operating table his condition became serious and the operation was stopped. Death occurred within thirty-six hours after the accident, and the postmortem examination was performed by Dr. Cassasa within twenty-four hours after death. No fractures were discovered. There was distention of the pial veins and edema of the meninges, especially over the convexity of the cerebral hemispheres, with moderate cellular infiltration into the pia-arachnoid spaces. There were punctate hemorrhages in the centrum ovale, corpus callosum and pons. The whole brain, with the exception of the cerebellum, had a moth-eaten appearance when examined microscopically — état criblé. Some of the Purkinje cells of the cerebellum stained faintly, having lost a considerable amount of the tigroid substance. There were fibrin thrombi in many of the smaller cortical blood vessels and in the choroid plexuses. These thrombi gave a basophilic staining reaction similar to that given by calcium. There were fat emboli in many of the cortical vessels. It is my belief that the trauma produced a disturbance of the colloidal equilibrium of the calcium in the blood stream facilitating its precipitation. The same factor was responsible for the fat emboli. This pathologic change indicates that the condition which we denote as concussion may produce pathologic defects in the nervous tissue.

Dr. C. O. Fiertz (by invitation): I would draw attention to what appears to me to be the most profound work on concussion that has appeared for the last few years, the studies of Ritter who attempts to separate the so-called concussion of the brain into three different clinical entities. As a theoretic basis for his conceptions he used the experimental work of recent years, especially that of Breslauer and of Kocher and Rahm. Breslauer showed that compression, which in general is considered as being the main factor in the concussion, may produce loss of consciousness if applied to the medulla oblongata, with much less intensity than would be necessary to produce cortical lesions. He experimented on animals, especially on dogs, and found that compression when acting on the medulla instantly resulted in unconsciousness, coma or even death; whereas local compression of cortical areas was without effect on the consciousness of the animal. He tried local compression by means of injections as well as by direct digital compression.

Ritter studied the material obtained at the surgical clinic at Zurich, Switzerland, during the last twenty-five years and collected over 600 cases. An extensive clinical study showed that in the term concussion was embraced many various disorders and troubles which made a definite statement on actual treatment and prognosis very difficult. He therefore tried to analyze these conditions and seemed to succeed in establishing three well defined clinical entities, each having its own clinical picture, symptoms, prognosis and duration. He differentiates commotio medullae oblongatae, commotio cerebri, sensu strictu, and contusio cerebri diffusa.

Commotio medullae oblongatae: This includes unconsciousness, disturbances of respiration and circulation, vomiting and changes in the blood pressure; in brief, nothing but symptoms referable purely to the medulla. Loss of consciousness is its outstanding feature, and is always accompanied by a retrograde amnesia. The duration of all these symptoms is short and they are most pronounced immediately after the trauma. In other words, we have to deal with nothing but the pressure curve of Kocher read backward, showing its full development at the beginning and then gradually vanishing. The

after-effects — general weakness, rapid fatigability, lack of concentration, labile mood, dizziness and headache — are of transitory character only and vanish completely without leaving residuals. About 65 per cent of such cases did not show these after-effects at all and when present the duration was short, an average of from three to six months, the maximum being three years. The average time needed for recovery was twenty-nine days.

Commotio cerebri, sensu strictu: Concussion of the brain in the strict sense of the word is characterized by the presence of definite cortical symptoms — vertigo, swaying gait, headache, malaise, loss of appetite. There occur quite irregular irritative symptoms of the cortex, such as slight twitchings of the limbs and face, mild pupillary differences, etc. Alterations of the pulse, as well as loss of consciousness and retrograde amnesia, are very inconstant. If loss of consciousness is present it may persist for ten hours, whereas in the medullary concussion its duration, in general, is only a few minutes and the maximum of about four hours is seldom reached. The absence, or at least not constant presence, of a primary affection of respiration or circulation, the only rare occurrence of vomiting and the absence of rise in temperature distinguish this syndrome from the preceding one. After the initial period of shock and depression or mental inhibition, lasting on an average from three to four days, there occurs a period of exaltation, lasting about four or five days. The after-effects are complaints of headache, dizziness, fatigability, general dulness and flickering of vision. The recovery averages about fifty-four days and the remaining symptoms last about nineteen months, the maximum being five years. The most important of the remaining symptoms is the so-called "encephalosis" which is characterized by a true weakness of memory, marked headache and dizziness, and general impairment of mental efficiency.

Contusio cerebri diffusa: In many instances there is only a quantitative difference between this form and the concussion just mentioned, but it is characterized by the presence of definite focal symptoms of an affection of cortical areas. Those focal signs may be slight and in general are very diffuse. Irritative and paralytic symptoms of the motor and sensory areas, auditory, visual and olfactory disturbances, agnosia, apraxia, aphasia, disturbance of the vegetative nervous systems, etc. may occur. All these symptoms are multiple, diffusely scattered and inconstant in their localization. They may vanish in one region and appear somewhere else; they last only a short time and may disappear in a few hours, sometimes in two or three days. Disturbances that last longer must be considered as being conditioned by more severe local lesions. There occurs an almost constant elevation of temperature up to about 101 which may persist for about a week. The duration of the after-effects, which, of course, in this form are more marked than in the other two, is rather long, sometimes five to ten years, sometimes remaining for the whole life. The average time of recovery was ninety-eight days.

These three well defined characteristic entities and their clinical differences are matched by the anatomic observations. Concussion of the medulla reveals no sign in the microscopic examination, proving Breslauer's statement that pressure on the medulla may be disastrous. In the second form we find degenerations of the fibers as a lasting feature, but as a rule only signs of an acute alteration of the nerve cells which in general recover. The absence of hemorrhages has been emphasized long before by Roussy, Lhermitte and Cornil, Jakob and Bikeles as characteristic. In contusio cerebri we find several kinds of alterations of the tissue, especially small hemorrhages and their sequelae.

As to the interesting paper we have just heard, I would like to add a few words. The comparison of symptoms in concussion and encephalitis is striking, but what would be found if the same comparison was made after two years? I think the conditions would then be entirely different; a great many of the symptoms would have disappeared and the clinical features of the two diseases show marked differences. Von Monakow always emphasizes the principal and fundamental difference between traumatic lesions of the brain without infection and without toxic influences, which all have a good prognosis, and the infectious, inflammatory and toxic diseases of the brain which only rarely lead to a full recovery and are liable to produce lasting symptoms.

DR. A. M. RABINER: The cases referred to were associated with trauma, but pathologically proved to be typical epidemic encephalitis. I do not think they can be considered in the group under discussion tonight. I was interested in this attempt to compare groups of patients with epidemic encephalitis and cerebral concussion. A study of the physical signs, however, would not reveal such a similarity as was disclosed by the tables of subjective complaints. After all, such symptoms as weakness, headache, vertigo, etc., occur in many other clinical syndromes unassociated with trauma or encephalitis. And so conclusions are not definite when comparison is made only as to subjective complaints between two clinical entities, one known to have definite pathologic change, and the other with no proved pathologic changes. The case studied by Dr. Cornwall reveals interesting changes. His work, however, was done many months after the necropsy, and such uniform vacuolization may be artefact.

DR. IRVING H. SANDS: If anything was proved tonight, it was the fact that the term "concussion" is poor and should never be used. It is true that it was arbitrarily used to describe cases showing neuropsychiatric reactions after some insignificant trauma when we were morally certain that no anatomic alterations had occurred within the cranial cavity. However, those who have had clinical and pathologic experience have long become convinced that no one can at any time definitely say that a patient who has received a blow on the head did not have anatomic changes in the brain. I have been privileged to follow neuropsychiatric cases in the late war and have been following them since then in the United States Veterans' Hospital no. 81, New York. I have also had the good fortune to make the cerebrospinal postmortem examinations of the cases at the Jewish Hospital. The greater my experience, clinical as well as pathologic, the more convinced do I become of the fact that a great injustice has been done to those who have sustained cranial injuries. Especially is it true at present, when everybody, regardless of qualification in training or experience, speaks in psychologic terms, and, because of much verbal imagery, quite vociferously. Such opinion is accepted without challenge. I have seen patients, who for four or five years had been regarded as having hysteria, develop definite hemiplegias and other signs of organic brain disease at the Veterans' Hospital. The extent of the injury to the brain from a fall or a blow on the head will depend on many factors among which are the age of the patient, the condition of the blood vessels, the distance through which the person fell, the strength of the force of the blow, the angle at which the force was directed, etc. One can never fully determine the extent of the injury until the brain has been thoroughly examined postmortem. Meyer (*American Journal of Insanity* **60**:373 [June] 1904) called attention to the fact that there are several places where the brain is apt to be injured whenever the skull is struck: namely, the tips of the temporal lobes, the orbital surface of the frontal

lobes and the area around the third ventricle. We also found that the pons was frequently the seat of injury, and often there is extensive subpial hemorrhage. The vacuoles to which Dr. Cornwall has called attention were present in our cases and are due to the fact that with the impact of the blow the cerebrospinal fluid is forced out from the Virchow-Robin lymph space into the pericellular space, and the vacuoles represent the distended pericellular space. We have also seen the ruptured capillaries which were shown by Dr. Cornwall. It is difficult to prognosticate in these cases; and often a person with extensive frontal lobe injury may live for many years, while another with a relatively small pontile and medullary hemorrhage will die. Furthermore, the fracture of the skull per se may mean a favorable result as it acts as a decompression operation.

Dr. Giliberti: Dr. Rabiner said he would be interested to know the difference a few years later in symptoms of the cases of concussion compared with the cases of encephalitis. As I stated in the body of the paper, the lesions of simple concussion show a great tendency to resolution and practically all the patients get entirely well. If they lose their symptoms, and we are trying to explain the symptoms on the basis of organic brain lesions as our slides demonstrated, the brain lesions must have improved; whereas in the case of encephalitis with residuals the tendency is for a chronicity of the lesions, and naturally the symptoms continue because the pathologic condition in the brain remains practically unaltered.

In regard to Dr. Fiertz who mentioned cases of concussion without loss of consciousness, I cannot quite understand that condition, because cerebral concussion, according to the definition ordinarily accepted, has loss of consciousness as one of its principal manifestations. In addition, he divides the various forms of cerebral concussion into three groups as evidenced by focal symptoms. Of course, you can subdivide these cases of concussion into any number of groups depending on the prominence of symptoms in different parts of the brain, but simple concussion means concussion of the entire brain, because it is inconceivable that a blow to any part of the skull, causing a sudden and momentary increase in the intracranial pressure, can affect only one small area of the brain and not the entire contents of the skull; the hydrostatic pressure would be the same all over. The reason I think there is more hemorrhage in one part than another depends possibly on the strength of the fibrillar attachments to the perivascular walls and other inherent characteristics of the brain in question. In addition, I wish to state that whether or not there is a fracture of the skull has no great significance except possibly that its occurrence may be in favor of the patient. With a blow of a certain intensity to a skull of a certain strength, if the skull fractures it will tend to protect the brain underneath, unless a depressed fragment of the skull lacerates the brain; but if the skull does not give way, there will be a greater momentary increase in intracranial pressure and greater symptoms will result. The cases of penetrating wounds which Dr. Sands mentioned are easy to understand because the damage was sharply limited and not widespread enough to bring about a condition of true concussion, in spite of the fact that a small part of the brain tissue was actually damaged.

A Brief Discussion of Two Books on Some Recent Anatomical Investigations. Dr. Smith Ely Jelliffe.

ANATOMIE CÉRÉBRALE. LES NOYAUX GRIS CENTRAUX ET LA RÉGION MESENCÉPHALE SOUS-OPTIQUE SUIVI, D'UN APPENDICE SUR LA MALADIE DE PARKINSON. By FOIX and NICOLESCO. Paris: Masson et Cie., 1925.

DIE CYTOARCHITEKTONIK DER HIRNRINDE DES ERWACHSENEN MENSCHEN. (WITH AN ATLAS OF 112 MICROPHOTOGRAPHIC PLATES.) By CONSTANTIN FREIHERR VON ECONOMO and GEORG N. KOSKINAS. Berlin and Vienna: Julius Springer, 1925.

Since Dejerine and Mme. Dejerine made their noteworthy contribution to the anatomy of the nervous system, no great French classic had even vied with its unrivaled brilliancy. In fact, it is doubtful if any work anywhere combined as did this great masterpiece that most inimitable of qualities of the French mind, clarity and terseness, with an equal profundity and thoroughness contributed by Mme. Dejerine-Klumpke, a daughter of an illustrious family with whom we could claim some kinship as she was of Californian birth of German origin.

It is a pleasure, therefore, to call attention to this new work of Foix and Nicolesco, conceived in the same sincere manner and executed with an exemplary thoroughness. It deals with the basal ganglia, the hypothalamic nuclei, the nuclei of the tuber cinereum and mesencephalic structures generally. They first take up the general topographic relationships; then consider in detail, by serial sections in all three planes, the myelo-architectonic as well as the cellular constitution. Each nuclear mass in this complicated region is exhaustively studied and beautifully illustrated. Finally the authors add a chapter on the pathologic changes of paralysis agitans.

The second book is really a great event. Its appearance marks a milestone in the study of the cerebral cortex. One recalls the early efforts of Bevan Lewis, Bolton, Campbell and Brodmann. Now comes the monumental work of Von Economo and Koskinas. A cursory glance discloses it to be dedicated to the "problem of problems." Somebody finally has attempted to chart the human brain, rather than drop flags on the floating ice of the North Pole.

Whatever may be the changes and reactions of scientific and philosophic opinion, this tradition has afforded an unqualified fund of facts on which opinions concerning the composition of human characters must be based. The authors have manifestly embedded their work in that tradition and have built, for cyto-architectonics, a keystone of exactness and completeness. One catches at once the spirit of objectivity in its most striking modernity. The 800 page text is divided into a general and a special part, the latter section describing and analyzing in systematic and comprehensive detail a separate atlas of 112 immense photographic plates. One can hardly be more truthful than a photograph, especially when one does not retouch as the authors assure us they have not done. The atlas is not only the most important part of the work, but it is an innovation born of foresight and a desire for perfection. A section of the cortex, normally about 3 mm. square, appears on a faultlessly clear plate over a foot square. Each plate is scaled so that, by a simple calculation, one easily arrives at the normal size of any distance on the plate, the spatial relations of the particular slide in the brain, or the actual number of cells de norma.

The text matches the atlas in a continuation of its thoroughgoing objectivity and particularly in its leisurely comprehensiveness. Following a historic and

systematic introduction in which the authors, ever consistent, refreshingly return credit to those who deserve it, there are exhaustive chapters on the morphology and relation of the cells, the development of the forms of cortical tissue to be discussed, and the anatomy of the various layers of the cortex with a view to their differentiation. The authors compare their own studies and plates with tradition and find that they can serve both without deviating from their goal. The morphologic division of the cortex as a whole into two types has its origin in Brodman's comparative studies. The authors accept Vogt's terminology for these types but adduce a complete series of their own sections and several plates to illustrate the validity of the isocortex and the allocortex. The results of myelo-architectonics are drawn on for further corroboration and also the comparative studies of Jacob which led the latter even beyond this goal. The isocortex is the normally six layered mantle whose greater or lesser variations from the type are heterotypic or homotypic. This type of cortical formation is found in the preponderating mass of the brain surface with the exception of the primary olfactory brain and the parts derived from it. These latter possess a cortical formation of another order and constitute the allocortex. The authors adduce evidence to show that the allocortex is laid down in the third month about three months prior to the isocortex and permit themselves the opinion that the same concurs with the rudimentary and primitive differentiations of the allocortex.

In continuation of the tradition of areal differentiation, the authors have raised the number to seventy-six more or less definite fields, and 107 when the major modifications are included. Brodman had raised Campbell's twenty-nine to about fifty, but the authors expect to see their own number increased and verified by an even greater intensification of the microscopic method. These areas are, however, specific only in respect to their immediate vicinity. In the isocortex they generally disclose one or another of five types of layer formation and it is the distinguishing contribution of this work to have introduced this morphologic basis. The broad banded, agranular type of cortex possesses large pyramidal cells (apart from the Betz giant cells) and a well developed sixth layer, but few granular cells, and is found parietally and on the median wall. This type often forms a combination with type 1, as in the whole second and third temporal lobes, the operculum and the gyrus postcentralis. The third, or parietal type, discloses an even greater development of the granular cells. At the frontal pole as well as occipitally is the polar type of cortex, thin banded and filled with small cells. The occipital as well as the medial lining of the calcarina and a strip along the inner wall of the hippocampus possess the completely granular or koniocortex, the archtype of sensory cortex denoted by Meynert. The relation of the areas to these five basic types of lamellated isocortex is then in the nature of a metamorphosis from one type into another or within a type, changes sometimes slight and at other times more abrupt.

In the wealth of detail amassed in the special section there is still evidence of an orderly review of the material. For each separate area there is a regular plan of paragraphic analysis and it is especially in the paragraphs on the physiologic importance of the areas described that the authors display an enviable regard for the difference between fact and fantasy. The question of localization in respect to the major sections of the cortex is delicately handled

in view of the insecurity of that topic since the work in encephalitis and the aphasias. Von Economo's own previous studies have done not a little to disclose the importance of the subcortex in cortical physiology and he further concurs in the conclusions of modern psychiatry that many functions are hardly to be localized at all except in the organism as a unit.

At every point the work has lived up to its tradition and its premises and is in every way a *Realencyclopedäe* on the study of the cortex.

Book Reviews

HYSTERIA. By ERNST KRETSCHMER, M.D., Nervous & Mental Diseases Publishing Co. A. O. Professor of Neurology and Psychiatry in Tubingen, Germany. Translated by OSWALD H. BOLTZ, M.D. Pp. 120. Washington, D. C.

In this small work the modern theory of hysteria as a form of reaction rather than a mere clinical syndrome is discussed in terms of psychology, neurophysiology and biology. The fundamental ideas of Kraepelin and Freud are consulted and correlated with the author's own wide and interesting observations. His conception of the hysterical as opposed to other psychogenic reaction types is based on three main trends: the reaction is a preformed mechanism, a reliving of old pathways; it serves a purpose; and it makes use of reflex, instinctive, impulsive activities. The entire work is an effort to blend harmoniously these three trends.

Two main groups of hysterical manifestations are described, the first of which is the primitive, instinctive, "violent-motor-reaction." We see this throughout the animal scale. The swimming infusorium thrashes about in the face of danger or discomfort until freed when it quietly swims away. Adult man, under certain conditions, harks back to this instinctive type of reaction, and in panic is again controlled by "violent-motor-reactions"; he screams, trembles, twitches and runs aimlessly about. If one of these activities removes him from the sphere of danger he returns to a state of calmness. Hysterical attacks, with their violent emotional phases, tremors, convulsions and aimless running away, are atavistic "violent-motor-reactions," instinctive as opposed to rational.

The second group of hysterical manifestations, the hypnoid-stuporous types, develops around the "sham-death reflex," and may also be traced through the animal series. This condition is closely related to catalepsy and hypnosis; there is partial loss of reaction to outer sensory stimuli and, in particular, well marked analgesia. In the musculature there is immobility and relaxation, increased tension or tremor. Such hypnoid-cataleptic conditions may be compared with similar conditions in man when they appear in reaction to danger and erotic shock. There are many abortive or residual forms of the "sham-death" reflex, among which the author mentions: concentric visual field narrowing, analgesia, deafness following injury to the tympanum, general stupor, hysterical deaf-mutism and hysterical stammering.

There remains a third large group of hysterical manifestations in which there is more or less tendency to sham, defense and flight. This group makes use of accidental material which crops up in the person's life, building a healing sciatica into a limp, a gastro-intestinal upset into hysterical vomiting, and a slight head injury into pseudo-dementia.

Hysteria arises by preference from two main sources, the instinct of self preservation — in the form of fright and anxiety toward dangerous situations — and from all the emotions and conflicts which accompany the sex life. Fright neurosis and hysteria, while closely similar, are to be differentiated. The former is to be considered an acute, instinctive, transient and spontaneously healing affective reaction; the latter is present only when such acute reactions become secondarily fixed through the purposeful interference of a "will to sickness"

or an advantage by sickness. While the fright reaction is essentially instinctive, the secondary hysteria lies rather on the boundary between the instinctive and the rational.

The author recognizes an exclusive relation between hysteria and the impulsive life, but differs from Freud in that he attributes only one half of that relation to the sexual impulse; the other equally large and important half is formed by the hysterical fright and anxiety reaction. Combinations can occur as, for instance, a latent hysterical reaction laid out by erotic psychic conflict being developed into expression by an acute fright.

In the field of neurophysical dynamics the author attempts to explain the transformation of psychic energy into hysteria. "If the symptom picture is a deception, how is the deception accomplished?" His explanation lies in the voluntary reinforcement of a reflex. In eliciting one's own patella reflex, if, just as the reflex hammer strikes, a slight voluntary tension is transmitted to the quadriceps it will be noticed that the slight voluntary movement has a feeling of extraordinary facility. This is due to harmonious fusion with the reflex. Another example may be found in the tendency to tremor in the leg muscles after mountain climbing or running, in the form of foot clonus, when, in sitting, only the anterior part of the foot rests on the ground. It disappears after rest, but the feeling of excitation in the musculature remains for some time, indicating that the reflex path is still open. By a slight voluntary hypertonicity in the muscles it is possible to keep the clonus in operation.

Tremors, like other emotional discharges, arise under strong influence, and fade away after a period of rest. Now suppose, at the time when a simple affective reflex is beginning to become automatic, that the patient contributes toward its support a slight volitional impulse. It would then be quite possible for the patient to maintain the tremor long enough voluntarily until it would go over into the chronic, reflex form in which it would again become more independent of voluntary support. In this manner, the author believes, the fine tremor of fright or fatigue is transformed into the coarse, clonic form of shaking tremor. An excellent illustration of this mechanism is given in the report of an army medical officer who awakened from a sleep of exhaustion with a coarse, shaking tremor of both arms. Following his first impression of surprise, he considered whether it would be of advantage to utilize the symptom. He decided against such tactics and with difficulty suppressed the shaking. In spite of his poor physical condition, the shaking itself in no way fatigued him. The following morning, and this is the interesting observation, the arms were quiet, but the shaking mechanism was completely at his command. He could without difficulty either shake his arms or hold them quiet. After a lapse of eight days the shaking mechanism could no longer be brought back.

In the third stage the shaking tremor is accompanied by increased muscular tension and psychic excitement. The muscular tension is the descendant of the volitional stimulus which reinforces the reflex process. The removal of this muscular tension is one of the main principles of treatment. Passive movements, relaxation commands, and the sudden demonstration of the absence of the tremor, rather than suggestion, comprise the principal treatment. The next step is by hard drilling to develop strong purposeful movements in place of the false muscular tension which exaggerates the reflex.

The third typical symptom is the psychic overexcitation. Some persons, as in severe neurasthenias, are for weeks and months still affectively overexcited and constantly on the verge of trembling spontaneously. Most tremor patients,

however, do not suffer from such serious emotional disturbance. Whatever shock existed subsides after a few days, making room for an artificial psychic overexcitation, which comes to expression in complaints of shyness, anxiety, timidity, irritability and sensitiveness to noise. They store up excitatory material from trifles and from harmless noise, thus loading up with emotional fuel to keep the reflex machine going.

It is emphasized that these three stages are not distinctly marked in all cases. A persistent tremor reflex often does not occur and the second stage leads over into the residuals of an hysterical habit formation. Here we have irregular, inconstant, chance tremor. In the severe neuropathies with manifestations of congenital inferiority and in chronic emotional tension in not very robust personalities the first stage may be entirely lacking. In such cases smaller emotional stimuli are sufficient to call forth as much subthreshold tremor excitation as the will requires to take hold of. Anger, a reprimand or criticism may precipitate the shaking.

Another reflex association must be considered — the unison of action between muscular movement, sensibility and the vasomotor system. Kretschmer attacks the contention that hysterical disturbances of sensibility are suggested by the physician. He speaks of the sensory "forgetting" of an arm which has been lying motionless in sleep; also, of a remnant of the reflex process that exists biologically between sensation and movement, and third, of changes in the venous circulation of a motionless, hanging arm. He believes that the deterioration of vasomotor relations in turn acts unfavorably on both sensibility and motion and that there is set up a vicious circle of theoretically unlimited range. To explain a flaccid monoplegia, it would be necessary only to substitute for sleep one of the other causes of reflex muscular flaccidity — fright, exhaustion or a fixative bandage. This form of hysterical akinesia would develop in the same manner as the tremor, already described.

The author then describes in detail two "wills" of the hysterical person — a normal purposive will, in no way differing from the personality, and an abnormal will, acting like a foreign body against the personality. This foreign "hypobulic will" is blind, reacting to nothing but the impression of the moment. It is amenable not to reason but to entirely different influences: a sharp command, a sudden blow, a pain or a clutching. The hypobulic will dovetails with the reflex apparatus; at one time it presents a tremor or convulsion, and at another a lower reflex psychic process, a twilight state or an impulsive explosion of affect. The purposive will lacks energy, the hypobulic will a goal. When the purposive will becomes insufficient through sudden mental shock or chronic affective disharmony the hypobulic will takes possession. The latter stands between the purposive will and the reflex, can attach itself autonomously to the reflex apparatus, and, united with it, can bring forth a shaking syndrome in accordance with the laws of voluntary reinforcement of a reflex.

The hysterical psyche tends to elude difficult experiences rather than to face them. It attempts to push aside disturbing ideas, to modify them into something tolerable and pleasing. For these purposes there appear, as an exact counterpart of the hypobulic splitting of the will, hyponoic mechanisms of thought in the form of double consciousness, dreams, attacks and twilight states. Repression is a common hysterical defense; the patient wishes to forget, partly blocking off and ignoring reality and partly giving it a new interpretation, in order to preserve from disturbance the happy hyponoic island of consciousness. In place of abstract words and thoughts, there are images. At night there are dreams and visible images. The hysterical twilight state may be taken as a typical hyponoic formation.

One must recognize a further purpose in these sometimes complicated twilight states. They are to be considered also as attempts to correct external injurious experiences. They aim theatrically to excite fear and sympathy, to put the surrounding world in a favorable mood toward the actor, or even to exercise an active mastery over it. They are an effective means by which physically weaker persons escape from and triumph over stronger oppressive ones, just as the "sham-death-reflex" can rescue a small animal from the teeth of its pursuers.

From the twilight pantomimes one meets with all transitions up to the hysterical attack; from affect pantomime to "affect epilepsy." In the hysterical attack, as in the twilight state, the spasmodic motor discharges express either the primary fright or other affect of the distressing experience, or they mirror the wish fulfilment in the gestures of ecstasy.

The book is thoroughly worthy of study and opens a pathway for a truly dynamic interpretation of functional disorders which may have far-reaching effects in the realms of therapy and prevention. It serves to bring home a realization of what still remains to be done in establishing the biologic, "evolution and dissolution" significance of mental mechanisms.

HANDBUCH DER NEUROLOGIE DES OHRES. By PROF. DR. G. ALEXANDER, PROF. DR. O. MARBURG and DR. H. BRUNNER. Vol. I. Parts 1 and 2. Rtm. 33.60. Pp. 1164. Vienna and Berlin: Urban & Schwarzenberg, 1923 and 1924.

It is not at all a matter of surprise that there is now appearing a work dealing with the neurology of the ear. If anything, its advent has been delayed too long. In recent years, particularly because of the development of the vestibular tests, neurologists and ear men have become more familiar with each other's work. To the neurologist ear functions, comparatively, are of greater importance than those of the eye.

The handbook will consist of two volumes. The first has already made its appearance and in two numbers. It is edited by Prof. Dr. G. Alexander, head of the Ear Clinic of Vienna, Prof. Dr. O. Marburg, who has charge of the Neurologic Institute in Vienna, and Dr. H. Brunner, assistant in the Ear Clinic of Vienna. While the work has had its conception in Vienna, nevertheless, among its contributors are some of the outstanding figures in both specialties in Austria, Germany and Holland.

The conception of the work is excellent. The first number is divided in two general parts, (*a*) normal anatomy, and (*b*) physiology and psychology; the second number of the first volume is divided into pathologic anatomy and the clinical examination methods. The second volume, which has not yet appeared and which was promised for the end of 1924, will discuss diseases of the nervous apparatus in affections of the outer and middle ear and the diseases of the cochlear and vestibular system.

The present review concerns itself with the two numbers of the first volume. There are altogether 1,164 pages containing 409 black and white illustrations and two colored illustrations with ten tables. Perhaps the best illustrations are included in the parts written by Alexander, Kolmer and Marburg.

In such a large work it is difficult to pick out any particular section for analysis. In the anatomic division the macroscopic anatomy of the nervous part of the organ of hearing is discussed by Alexander and the microscopic anatomy by Kolmer; the development, macroscopic and microscopic anatomy of the cochlear and vestibular nerves, and the cerebellum and its related centers and tracts by Marburg. These parts are exceedingly well done.

The physiology of the outer and middle ear is discussed by Kisch, the physiology of the inner ear with the central cochlear tracts and centers by Kreidel. There is an exceedingly interesting chapter on tone psychology by Köhler. To the reviewer the most interesting discussion in this volume is by Magnus and de Kleijn on the experimental physiology of the vestibular apparatus, in which their well known views are given an adequate presentation. Dizziness is discussed by Leidler, and the functions of the cerebellum, this including the physiology and general neuropathology, by Dusser de Barenne. There is an additional chapter on the physiology of the cerebellum by Karplus.

The discussion of the cerebellum by Barenne and Karplus is along classic lines. The cerebellum is a central organ for innervation of voluntary muscles, its influence regulating and coordinating all its activities. They also assume that it is a center for tone. The neuropathology and clinical symptoms are well presented and follow modern lines. Cerebellar localization is admitted as possible but not widely discussed.

The division on pathologic anatomy of the ear by Professor Alexander is admirably done. It is perhaps the best contribution in the book. This part also contains a general discussion of the pathology of the central nervous system by Professor Marburg, and is along the usual lines.

Perhaps the division which concerns itself with clinical examination methods will be of greatest interest both to neurologists and to ear men. The outstanding contribution is by Professor Brunner on the general symptomatology of the diseases of the vestibular apparatus and its central connections. There is no better discussion of nystagmus anywhere and the description of the clinical examination of the labyrinth, particularly the so-called Bárány method, is given with the greatest detail and understanding. The differentiation that has been made by some American authors between the vertical and horizontal canals is not commented on. This is a mistake, for such a distinction clearly exists.

Altogether the two volumes which have already appeared have been admirably done. They should be in the possession of every up-to-date neurologist and ear man. It is to be hoped that they will be translated into English.

THE INHERITANCE OF ACQUIRED CHARACTERISTICS. By PAUL KAMMERER, PH.D. Translated by A. PAUL MAERKER-BRANDEN. Cloth. Pp. 414. New York: Boni and Liveright, 1924.

This book was written in defense of the thesis that acquired characteristics may be inherited. In the first or biologic part, Kammerer first reviews the work of others. He accepts the conclusions of his predecessors that color changes produced in butterflies by exposure to heat or cold are transmitted to the progeny, although he admits that the conditions of the experiments were such that the possibility of direct influence on the germ plasm could not be ruled out. Likewise he accepts the validity of the conclusions on the effect of heat and aridity on beetles in producing changes that are passed on to succeeding generations, although it is possible that the acquired characteristics are not really new but are the resurrection of old ones.

Kammerer's own experiments were designed to avoid the charge both of "parallel induction" and of "atavism." For this purpose he chose the spotted salamander. By keeping the female out of water for about two years he succeeded in lengthening the period of gestation with the consequence that, instead of "floundering larvae," the progeny at birth were "completely developed

little salamanders breathing through lungs" with "sturdy little legs and a cylindrical finless tail." At the same time the number of progeny in a birth decreased from fifty to six, four or even two. As a result of their growth in a salt-containing medium in the womb, the salamanders became "monotonously black." With a sufficient number of repetitions, succeeding generations also became late-bearing, and produced fully developed salamanders exhibiting the same changes in size, coloring, etc.

Again, succeeding generations of spotted salamanders kept for a few years on a dark background appeared mostly black; if kept on a yellow background they became mostly yellow. When these newly developed color types were crossed with naturally striped types, the progeny were subject to mendelian rules.

Even more convincing was the result of amputation of the siphons of the sea squirt. The offspring of the amputated specimens developed siphons longer than normal. The results of this experiment directly contradict the Weismann results from cutting off the tails of twenty-two generations of mice. Kammerer believes that if Weismann had cut off the tails of his mice before they were sexually mature, or had deprived fully matured animals of their tails shortly before conception, the progeny would actually have been born without tails. In general, however, he assumes that not mutilations, but their results can be inherited, because they constitute a stimulating reaction of the mutilated living being.

Kammerer cites the results of experiments on the effect of changes in environment on plants and unicellular organisms, as well as on the higher animals and on man. After summarizing the arguments for and against his thesis, he concludes that changes in environment, rather than chance variations, are the prime factors in producing new characteristics, and that natural selection works rather in a negative fashion only to eliminate those variations which prove to be detrimental or impractical. This is to him the only satisfactory explanation of the mechanism of evolution.

The book is essentially optimistic. In stressing the outstanding importance of environment it should be especially stimulating to the neuropsychiatrist, who is too often hampered by a conviction of futility in his efforts in the field of mental hygiene. Instead of a passive reliance on the chance operation of the laws of selection, with our only suggestion that of the elimination of the unfit, we should utilize to the full the more potent, more controllable forces of the environment.

Because of the essentially controversial nature of the question, Kammerer is of necessity forced into the rôle of special pleader. This is unfortunate in that it occasionally results in a method of handling far more fervent than we are accustomed to find in an unbiased scientific work. There is, however, no evidence of bias in the book. Our impression is merely that, in his attempt to answer all criticisms, the author sometimes becomes so involved in argument as to lose sight temporarily of his main thesis. Another possible source of obscurity lies in the translation, which, in an attempt to adhere as closely as possible to the text, sometimes preserves the German idiom too literally. The book presents constant evidence of painstaking effort. The references, particularly, are excellent.